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Class IV Supply Planning Factors

by

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This research derives new Class IV supply planning factors appropriate for updating the Army Force Planning Data and Assumptions used for Total Army Analysis and for supporting contingency planning and analysis at the division level or higher.

This research showed that the Class IV consumption rate varies based on the type and phase of the contingency. A single planning factor cannot accurately represent the Class IV requirements.

The study recommends that Army planners adopt the simple, one-page methodology for computing a contingency-specific Class IV planning factor as presented in Table 5-4. The study also recommends building interfaces between engineer and logistics components in the computer models used for contingency planning and military analysis.

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EXECUTIVE SUMMARY

High-level military planners use logistical planning factors to estimate the supply requirements of major regional contingencies. These planning factors are expressed in the unit of measure "pounds per person per day." The objective of this study was to update the planning factor used for supplies in Class IV: construction materials for base development, nonexplosive barrier and obstacle materials, and fortification materials. The Class IV planning factor has been 8.5 pounds per person per day for more than 20 years, and little documentation exists to show how the number was derived. The variety of contingencies currently being planned suggests that a single number is not sufficient. The study's product is, therefore, an algorithm for computing a Class IV planning factor suitable for each given set of contingency conditions.

The basic assumptions of the study are that the derived planning factor: (1) represents a "minimal requirement," unconstrained by engineer or logistic capabilities; (2) includes only construction tasks that are generally planned and executed; (3) excludes locally-procured materials (coarse and fine aggregate, mineral fill, etc.); (4) assumes ideal terrain and climate/weather conditions; (5) includes only materials moving through the military supply system; and (6) excludes construction requirements met by host nation or contractor support.

The study used a relatively simple computational method based on the concept that the daily consumption of Class IV supplies can be calculated as follows:

$$\text{Total Class IV Materials Per Day} = \sum_{\text{TASK}} (M_{\text{TASK}} * N_{\text{TASK}})$$

where M_{TASK} is the material requirement in pounds for a single task of type TASK, N_{TASK} is the number of tasks of type TASK performed per day, and the sum is taken over all tasks requiring the use of Class IV supplies. Dividing the daily consumption by the corresponding daily Army population yields the appropriate planning factor in "pounds per person per day." The tasks were grouped into two categories: (1) base development tasks (construction, maintenance, and repair of lines of communication and facilities) in the communications zone and corps area and (2) divisional and nondivisional unit barrier, fortification, and construction tasks.

The first phase of the study concentrated on computing consumption rates for several known contingencies. Input/output data used during the Total Army Analysis-2001 studies for the Force Analysis Simulation of Theater Administrative and Logistics Support (FASTALS) provided sufficient information to determine the number of tasks of each type required in three contingencies: Europe, Major Regional Contingency West (MRCW), and Major Regional Contingency East (MRCE). The material requirements for each task were calculated by using the task assumptions and facilities from the Army Facilities Components System (AFCS) that had been used by the Engineer Strategic Studies Center to update the FASTALS engineer workload factors in 1992. The Class IV consumption rates in pounds per person per day calculated for each of these contingencies were: Europe, 19.65; MRCE, 22.35; and MRCW, 15.90.

The study also investigated the Class IV requirements of Operation Desert Shield/Storm by processing item-level requisition data from the Logistics Intelligence File. The requisitions represented approximately 218 million pounds of material, most of it for barriers and fortifications. Under the assumption of a linear population growth over the 209 days from C-Day to cease fire, the consumption rate was 8.53 pounds per person per day. This rate was so close to the long-standing Class IV planning factor that researchers at the U.S. Army Construction Engineering Research Laboratories (USACERL) began considering the possibility that the planning factor is self-predicting. The potential for this is a valid concern because, both in OPLAN preparation and in military analysis, the engineering community's calculated Class IV requirement is not communicated to the logistics community. Transportation and supply handling requirements are computed by using the planning factor. The study recommends building interfaces between engineer and logistics components in the computer models used for contingency planning and military analysis.

The results of the first phase of the study indicated that the Class IV consumption rate varies considerably, not only from contingency to contingency but also during different time periods of a single contingency. To explore the factors affecting this variation and to derive a simple method for computing a contingency-specific planning factor, the study developed a spreadsheet simulation model called C4 to calculate a contingency's Class IV requirement given a small set of defining characteristics. The model inputs included: number and types of divisions, level of theater infrastructure, the threat's long-distance strike capability, unit movement patterns, host nation/contractor support, size of theater, length of conflict, and initial population and rate of growth. This information provided the framework for computing a task-by-task Class IV requirement. The C4 model was verified by replicating both the total consumption and the consumption rate that had been calculated earlier for each of the scenarios studied during the first phase.

The C4 model was used to generate 486 different sets of contingency conditions and associated Class IV consumption rates. Analysis of this large sample of data and application of optimization methods resulted in a relatively simple algorithm for computing a suitable Class IV planning factor for a new contingency. This algorithm produced consumption rates within 15 percent of the corresponding C4 consumption rates for all but 43 of the 486 original observations. These 43 observations were characterized by contingencies with a large initial force (>20,000) and no movement during the entire conflict—a situation which yields consumption rates that are much smaller than the base rate. Though all of the factors in the computation were derived mathematically, only the initial force factor is nonintuitive. It was derived by fitting a curve to a set of discrete data points. The study recommends the adoption of the method given below for computing a contingency-specific Class IV planning factor.

METHOD FOR COMPUTING A CONTINGENCY-SPECIFIC CLASS IV PLANNING FACTOR

A Class IV consumption rate for the first 180 days of a **major regional contingency** may be computed by using the following formula with factors from the appropriate tables below. This method assumes base development tasks are limited to airfields, roads, pipelines, supply storage facilities, EPW camps, and DEPMEDs using austere initial standard construction. This method does not apply to operations other than war (OOTW).

CLASS IV CONSUMPTION RATE = **BASE RATE** X **CONTINGENCY FACTOR** X **MANEUVER FACTOR** X **DEPLOYMENT RATE FACTOR** X **INITIAL FORCE FACTOR**

HEAVY FORCE

BASE RATE: **6.50** LB/PERSON/DAY

CONTINGENCY FACTOR:

THEATER	THREAT'S DEEP STRIKE CAPABILITY: None	Moderate	High
Well-developed	1.00	1.23	1.34
Developing	1.30	1.63	1.81
Austere	1.31	1.75	2.03

MANEUVER FACTOR:

Stationary	1.00
Withdraw/Defend/Attack	1.48
Move Every 20 Days	1.76

LIGHT FORCE

BASE RATE: **7.25** LB/PERSON/DAY

CONTINGENCY FACTOR:

THEATER	THREAT'S DEEP STRIKE CAPABILITY: None	Moderate	High
Well-developed	1.00	1.26	1.38
Developing	1.28	1.65	1.87
Austere	1.30	1.80	2.13

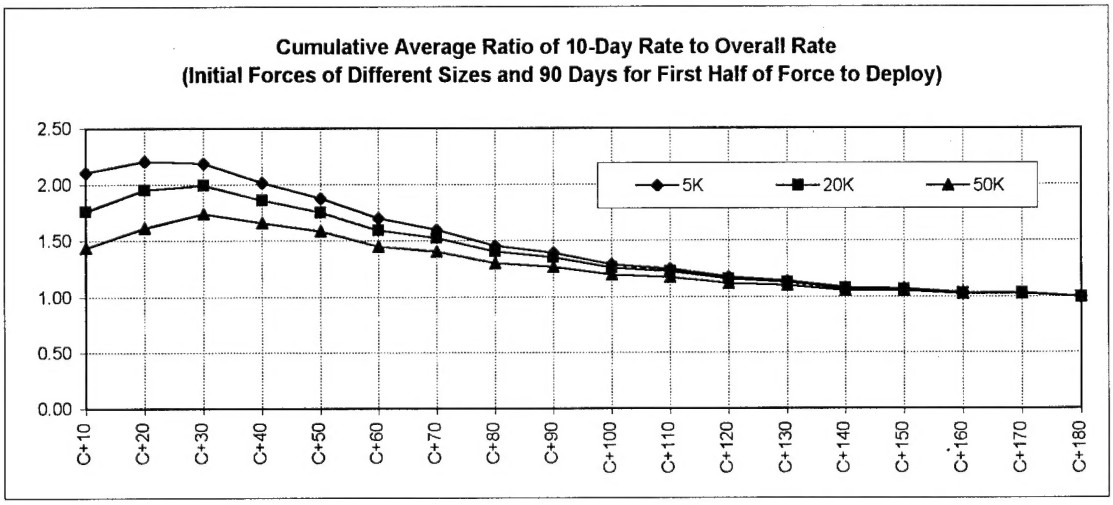
MANEUVER FACTOR:

Stationary	1.00
Withdraw/Defend/Attack	1.50
Move Every 20 Days	1.77

DEPLOYMENT RATE FACTOR: $(.975)^D$ where D = 0.1 X (90 - Number days to deploy half of force) and D is rounded to nearest integer

INITIAL FORCE FACTOR: $1.019 - 6.0\ T/1000 + 2.18\ T^2/100000$ where T = number of 1000s of troops present on C-Day

The consumption rate varies for different time periods during the 180 days by the multiplicative factors indicated in the graph below. Compute a rate for contingencies shorter than 180 days by multiplying the rate from above by the corresponding factor from the graph. Example: for 70-day contingency with 20K initial force, use 1.5 as multiplier.



FOREWORD

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The work was performed by the Facility Management Division (FF) of the Infrastructure Laboratory (FL), U.S. Army Construction Engineering Research Laboratories (USACERL). Carol Subick was principal investigator for the study. The study team included associate investigators William H. Flickinger, Prameela Reddy, and Gonzalo Perez. Dr. Francois Grobler also provided technical advice and support throughout the study. Alan Moore is Chief, CECER-FF, and Dr. David Joncich is Acting Chief, CECER-FL.

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CHAPTER 1: INTRODUCTION

Background

The Class IV supply category includes fortification materials, obstacle and barrier materials, and construction materials for base development and general engineering. Having a good, quick estimate of the Class IV supply requirements for a given contingency is crucial to high-level military planning and analysis, including the Army's force structure studies conducted under the Total Army Analysis (TAA) program and contingency planning using guides such as Field Manual (FM) 101-10-1/2. The analysis process in each of these cases uses a single consumption rate to estimate the gross tonnage requirements as a function of the number of soldiers deployed. The Class IV tonnage requirements in turn affect lift and haul capacities, storage requirements, deployment scheduling, etc. Currently, FM 101-10-1/2 provides a planning factor of 8.5 pounds (lb)* of Class IV supplies per soldier per day—a consumption rate that has been used with only minor variations for the past 25 years.

Many recent changes in military operations, mission requirements, and force structure have had a significant impact on Class IV supply requirements and on the planning factors used to estimate them. The number and variety of potential military contingencies has increased substantially in the past 5 years, and each new contingency has its own unique set of circumstances that may affect both the type and quantity of Class IV supplies required. The current planning factor does not capture this wide range of variability. Additionally, new rapid construction methods using light-weight materials bring into question the validity of the underlying data used in computing the current planning factor. Doctrinal and force structure changes that shift the burden of theater construction to host nation and contractor resources may actually require new sets of underlying assumptions and rules of application for the planning factor itself.

The current Class IV planning factors used in the Army Force Planning Data and Assumptions (AFPDA) for TAA and in general reference manuals such as FM 101-10-1/2 must be updated. Variations in requirements from one theater of operations (TO) to another indicate that a single number will not suffice. On the

* A metric conversion table is on page 80.

other hand, the computation of a contingency-specific requirement potentially involves processing a large amount of detail data that is not readily available to high-level planners. This study addresses the problem of deriving new Class IV supply planning factors by finding a middle ground between the simplistic approach of a single, fixed number that does not capture the range of variability across different contingencies and the complex approach that produces an accurate estimate for each specific contingency but requires too much time, effort, and information to compute.

Objective

The objective of this work was to derive and validate new Class IV supply planning factors appropriate for updating the Army Force Planning Data and Assumptions used for the Total Army Analysis and for supporting contingency planning and analysis at the division level or higher.

Approach

The study approached the problem in two phases. The first phase concentrated on deriving planning factors for each of several well-studied contingencies and relied on the existence of sufficient data to actually calculate the Class IV supply requirement for each contingency. These first calculations were straightforward and easily documented. This approach provided a firm set of beginning numbers that were studied and refined by subject matter experts—engineer planning staffs at the corps and Engineer Command (ENCOM) level. The second phase of the work focused on developing a simple algorithm for computing a contingency-specific planning factor from a given set of generally-known conditions, such as the number and type of units deployed, the level of the theater's existing infrastructure, and the relative capabilities of the threat.

The first phase was confined to the known contingencies used for the TAA-2001 studies. Comprehensive data sets have been established for these contingencies. The data sets provide enough information about the size and structure of the forces deployed, the theater infrastructure, and the support requirements to permit calculation of the actual Class IV requirement. In addition, these data sets have been thoroughly staffed from the Headquarters, Department of the Army (HQDA) level down to the individual branch proponents. This high level of acceptance of the baseline data will ease the study validation process and help to ensure that the derived planning factors are consistent with the assumptions of the AFPDA.

The study's second phase addressed the more complex issue of computing a planning factor appropriate to a given set of contingency conditions when the contingency itself is new and little is known about its requirements. This general methodology used the findings of the first phase as a starting point but relied most heavily on the input of subject matter experts. Records from the Army's recent experiences during Operation Desert Storm (ODS) were examined for patterns of Class IV supply consumption that could be adapted to more general rules of thumb regarding current practices. Even though ODS cannot be described as typical, some important observations can be drawn from its historical data regarding the effects of current material requirements and standard operating procedures on the Class IV planning factor.

Each phase of the study further divided the subject of Class IV supply consumption into the two relatively distinct areas of a theater of operations: echelons above corps (EAC), and corps and below. Typically, EAC activities concentrate on the base development tasks required to provide the infrastructure to support the war fighting effort: construction, repair, and maintenance of lines of communication (roads, airfields, railways, pipelines, seaports) and construction and repair of facilities (troop camps, storage areas, hospitals, enemy prisoner of war camps, maintenance areas, etc.). At corps and below, the Class IV supply consumption occurs mainly under survivability and countermobility missions: construction and fortification of positions and emplacement of nonexplosive barriers. These two Class IV areas of the theater link in the rear combat zone where the maintenance and repair of lines of communication (LOCs) may use both the available corps engineer assets and the combat heavy assets belonging to EAC units.

Mode of Technology Transfer

It is recommended that the results of the research be used to update the AFPDA and related documents.

CHAPTER 2: METHODOLOGY

Introduction

This chapter provides general information about military supply classification, describes Class IV supplies and how they are used in a theater of war, discusses basic assumptions of the current study regarding the use of Class IV supplies and of the planning factors to be derived, and outlines the general methodology for calculating a rate of Class IV consumption. The final section of the chapter summarizes the study assumptions and states the study's goal in terms of the characteristics of the derived planning factors.

Classes of Supply

The current Department of Defense supply classification system was adopted in 1967 and is prescribed for the Army in Army Regulation (AR) 11-8. The system uses the ten classes listed in Table 2-1.

According to FM 704-28, *Classes of Supply*, (p. 5-1):

> Classes of Supply are used extensively in the development of the logistic portion of Operation Plans (OPLANS) or Logistic Plans (LOGPLANS). Supply requirements are normally quoted in terms of "days of supply by class of supply" and logistic estimates are based on the same terms plus the term "pounds per man per day." ... The Army-in-the-Field (AITF) uses classes of supply in preparing plans, estimates, and orders.

This indicates that military planners think of supplies in terms of these very broad categories and base their supply calculations primarily on these ten major classes.

The current study focuses on Class IV. FM 704-28 contains graphics to illustrate the type of supplies that fall into Class IV, including bulk materials such as lumber, pipe, wire, nails, screws, and other types of construction hardware. The class also includes building components such as windows and trusses and installed

Table 2-1 Classes of Supply

Class	Description
I	Subsistence including gratuitous health and welfare items.
II	Clothing, individual equipment, tentage, tool sets and tool kits, handtools, administrative and housekeeping supplies and equipment. Includes items of equipment, other than principal items, prescribed in authorization/ allowances tables and items of supply (not including repair parts).
III	Petroleum fuels: lubricants, hydraulic and insulating oils, preservatives, liquid and compressed gases, chemical products, coolants, deicing and antifreeze compounds, together with components and additives of such products and coal.
IV	Construction materials to include installed equipment and all fortification/ barrier materials.
V	Ammunition of all types (including chemical, radiological, and special weapons), bombs, explosives, land mines, fuzes, detonators, pyrotechnics, missiles, rockets, propellants, and other associated items.
VI	Personal demand items (nonmilitary sales items).
VII	Major end items: a final combination of end products which is ready for its intended use; e.g., launchers, tanks, mobile machine shops, vehicles.
VIII	Medical material including medical peculiar repair parts.
IX	Repair parts and components to include kits, assemblies and subassemblies, repairable and nonrepairable required for maintenance support of all equipment.
X	Material to support nonmilitary programs; e.g., Agriculture and Economic Development not included in Classes I through IX.

equipment such as plumbing, electrical, and heating/ventilation systems. The typical barrier and fortification supplies in Class IV are barbed wire, concertina wire, fence posts, sand bags, lumber, and plywood. Explosive barrier/obstacle materials such as mines and detonators are Class V items; Class IV includes only the nonexplosive materials used for barrier/obstacle emplacement. Given these specific examples and considering the definitions of the other nine classes of supply, this study's assumption is that military planners, especially engineers, classify within Class IV *all* materials used for base development and barrier/fortification emplacement.

The Army logistics system, however, must approach the problem of supply classification from the other end of the spectrum. It must track millions of items of supply of all varieties imaginable. To do this, the logistics system assigns a

unique 13-digit national stock number (NSN) to each inventory item and uses an electronic database called the Army Master Data File (AMDF) to catalog the system. Within the AMDF, the class of supply for each item is recorded as a field in the item record by the item proponent. A spot check of the AMDF indicates that the typical barrier and fortification materials are classified as Class IV, although one type of sand bag (NSN 8105013314019) that was used extensively during ODS is classified as a Class II item. A thorough examination of the AMDF supply classification of the standard materials used for base development indicates that many of the items are not in Class IV but are in Classes II, VII, or IX. Most plumbing and electrical supplies are in Class IX. Class VII contains many of the major components used by engineers for construction missions, including Bailey bridge kits, preengineered buildings, membrane surfacing and landing mat sets, and liquid storage tanks and bladders.

The AMDF classification of base development materials into supply classes other than Class IV presented a problem for the current study. Determining whether the AMDF classifications are correct or not was well beyond the scope of the current study. The diverse nature of the classifications themselves, however, presented a dilemma:

1. Should the study determine a consumption rate for all materials used for base development and for barriers and fortifications, thus maintaining consistency with the way in which military planners think of Class IV supplies? or

2. Should the study determine a consumption rate for materials that are strictly classified as Class IV by the Army logistics system's standard catalog (AMDF), with the expectation that planning factors for the other classes will take the appropriate materials into account?

Since much of the data processing required to derive consumption rates was done electronically in a way that provided rates under each set of conditions without undue time and labor commitments, the current study avoided the dilemma by calculating the total materials required for base development and barrier/ fortifications as well as the total Class IV materials as defined by the AMDF. With the understanding that distinctions will ultimately be made between the different planning factors derived during this study, this report adopts the convention of using the term "Class IV supplies" in the broadest context to include all materials for base development and for barriers and fortifications.

Basic Assumptions

A number of very broad assumptions are associated with the high-level supply planning factors in general and with the Class IV planning factors in particular. As FM 101-10-1/2 states: "The factors may vary considerably with the force structure, mission, area of operation, and intensity of combat." The nature of this type of planning factor is to provide a "ballpark" estimate of the requirement, given very broad assumptions about the type of military operations being planned. To do this for Class IV supplies, the present study must identify the major factors contributing to the variability in the supply consumption rate and establish some measure of that variability that will allow planners to bound the range of the Class IV requirement within acceptable limits.

Though the Class IV supply planning factor is expressed in terms of a "per soldier per day" rate, Class IV supplies themselves do not fit neatly into this framework. The food supplies of Class I, for example, are closely related to the individual soldier and are consumed on a daily basis. But Class IV supply consumption is only indirectly related to the number of soldiers deployed and varies considerably from day to day, not as a daily consumption but typically as a one-time expenditure to meet longer term requirements. In the current study, the calculations are made to fit the format of the supply consumption rates because that is the most useful format for the macro-level planning models currently in use. A better representation of the Class IV consumption rate would be expressed in short tons (STON) per day. This study focused first on deriving that rate and determining how it varies in different areas of operation, under different types of conflict, and with varying sizes of deployed forces. Given the daily Class IV supply requirement and how that number varies with the size of the deployed force, the standard consumption rate in pounds per soldier per day can be computed. Though this method logically reverses the sequence of steps for estimating supply consumption, it yields a planning factor that is quantitatively accurate and appropriately structured for use in existing planning models.

Though some of the activities that consume Class IV supplies in a theater of operations are complex construction projects with unique material requirements, doctrine specifies that expedient methods must be used whenever possible. Engineer construction and fortification are mostly horizontal work—digging, leveling, and surface stabilization. This places a heavy reliance on the use of the natural and salvaged materials on hand to produce functional though very austere results. The local materials—especially coarse and fine aggregate and mineral fill—are the typical high-demand items; they are also the heaviest. Indeed, some concern has been expressed recently about the availability of these crucial supplies in certain regions of the world. To account for their weight in the Class IV

planning factors, however, would skew the numbers in such a way as to overshadow the Class IV supplies that actually have to be purchased, shipped, stored, hauled, and inventoried. The approach of the current study is to document the volume of the requirement for these local materials so planners can take them into account, but to exclude their weight in the calculation of Class IV consumption. The planning factor will include only those items that would normally be procured through the supply system or appropriate contracting authorities and, in many cases, would have to be shipped into the area of operations when they are not available from local suppliers.

The tasks that consume Class IV supplies in theater generally fall under the mission essential task lists (METLs) for countermobility, survivability, and sustainment, though not all of the tasks in the METLs actually consume supplies. Some of the tasks that require large Class IV expenditures are rarely required, and the tonnage of their supply requirements can vary significantly according to the engineering aspects of each individual project. This study omitted such tasks from consideration and based the supply planning factor on what is generally planned and executed. Certain contingencies may require large expenditures of Class IV supplies for special missions (examples: major expansion of an airfield or the complete restoration of a large seaport), but the current study cannot capture such outlying data. Offline calculations to adjust the planning factor can be made to handle these cases once sufficient information is available about their requirements.

Method for Computing the Class IV Requirement

For the derivation of the daily Class IV requirement, this study used a relatively simple method based on the concept that the daily consumption of Class IV supplies can be calculated as follows:

$$\text{Total Materials Per Day} = \sum_{\text{TASK}} (M_{\text{TASK}} * N_{\text{TASK}})$$

where M_{TASK} is the material requirement for a single task of type TASK, N_{TASK} is the number of tasks of type TASK performed per day, and the sum is taken over all tasks requiring the use of Class IV supplies. The tasks themselves were grouped into two major categories: base development tasks and barrier/-fortification tasks. Separate planning factors were derived for each category. This is consistent with the approach of the current planning factor, which has decomposed the 8.5 lb per soldier per day into 4.5 lb for base development and 4 lb for barrier/fortifications.

Application of the formula for determining the total materials per day required carefully constructed data sets for each of the three variables in the formula:

1. A list of tasks or activities that consume Class IV supplies,

2. A method for associating a bill of materials with each task, or at the very least, an aggregate weight for the materials required to perform a single task, and

3. A method for determining the number of tasks required per day for each type of task performed.

Of these three areas, the variability in Class IV supply requirements is concentrated almost entirely in the third variable: the number of tasks of each type performed per day. The list of tasks that consume Class IV supplies is relatively static. And the number of ways in which each task may be done has been reduced substantially in recent years because of two important operational requirements: (1) the standardization and containerization of supplies to simplify stockage and shipment, and (2) the standardization and simplification of task performance methods to ease the training burden. It is N_{TASK}, the number of tasks of each type performed per day, that accounts for the largest variations in Class IV supply consumption. Table 2-2 outlines of the major factors influencing this variability.

The factors outlined in Table 2-2 fall into two categories. The first category contains factors that determine the requirements—how much infrastructure is needed to support operations, how much damage is anticipated, how much maintenance is necessary, and how much fortification is required. The second category contains offsets to the requirements—how much in time and resources is available to perform the work, how many facilities are already available, what type of infrastructure already exists, and what local or nonmilitary resources can be tapped to fill the needs. The first phase of the study relied on workload data from the known

Table 2-2 Factors Affecting Variability of Class IV Requirements

Units deployed
Threat capabilities
Size of theater
Movement rate of forward edge of battle area (FEBA)
Length of conflict
Combat posture (offense, defense)
Battle intensity
Terrain
Climate
Combat and combat heavy engineer capability
Theater infrastructure
Host Nation support and resources
Contractor support

contingencies to determine the number of tasks of each type performed per day and to complete the calculation of planning factors for each of the contingencies used for the TAA-2001 analysis. To develop a more generally applicable algorithm during the second phase, workloads and material requirements were generated in a spreadsheet model using a hypothetical scenario constructed to match the sequence of operations most likely for the foreseeable future.

Tasks Associated With the Consumption of Class IV Supplies

Table 2-3 contains a list of the most common tasks that require the use of Class IV supplies. The structure of the task list indicates several things about the study breakdown and methodology. First, the tasks are divided into the two major categories of (1) base development involving construction, maintenance, and repair of LOCs and facilities, and (2) emplacement of barriers and fortifications. The study addressed these two categories separately. Secondly, the task list contains specific reference to the Force Analysis Simulation of Theater Administrative and Logistics Support (FASTALS) by identifying the task numbers used for each of the tasks actually represented in the simulation and used for engineer workload calculations. FASTALS is the model used at the U.S. Army Concepts Analysis Agency (CAA) during the analysis phase of TAA. The current study used the FASTALS input and output data to compute the Class IV requirements for each contingency. This initial computation is explained in detail in Chapter 3. Note that several tasks in the base development category do not have FASTALS numbers. Recent experiences in the Gulf War indicate that long-standing assumptions about theater construction requirements are not true in some regions of the world. Contingency planning based on operations in third-world countries introduces support tasks that typically have been omitted for theaters where the underlying infrastructure was sufficient. The unnumbered tasks in Table 2-3 were required in significant amounts during the Gulf War but are not represented in FASTALS.

Defining the Study Framework

Ask a combat engineer about Class IV supplies and the usual response is: "You can never get enough." This simple statement carries quite a few implications for the current study. What exactly should the study quantify in determining a "Class IV planning factor?" In an actual theater of operations, the amount of Class IV materials that are likely to be consumed will almost always be less than what good judgement would say was needed and would have been provided if the time and resources had been available. Further, what was needed will almost always be less than what was wanted.

Table 2-3 Tasks Requiring Class IV Materials

BASE DEVELOPMENT

FASTALS	DESCRIPTION	UNIT OF MEASURE
	Battle Damage Repair	
1	Road damage repair	Per Mile of Road in Use
2	Highway bridge damage repair	Per Mile of Road in Use
3	Railroad damage repair	Per Mile of Railroad in Use
4	Railroad bridge damage repair	Per Mile of Railroad in Use
5	Pipeline damage repair	Per Mile of Pipeline in Use
6	Port damage repair	Per STON Cargo/Eqmt Per Day
7	Army Airfield damage repair	Per Airfield
	New Construction—Facilities	
8	Troop camps	Per Non-Divisional Soldier
9	Administrative space	Per Non-Divisional Soldier
10	General supply storage	Per STON Dry Cargo Stored
11	Ammunition storage	Per STON Class V stored
12	Refrigerated storage	Per Non-Divisional Soldier
13	POL storage	Per STON Class III Stored
14	EPW Camps	Per EPW or Internee
15	ADA sites	Per Non-Divisional Soldier
16	DEPMEDS	Per Hospital Patient
17	Clinics	Per Non-Divisional Soldier
18	Maintenance facilities	Per Non-Divisional Soldier
19	Replacement camps	Per Replacement Per Day
20	Road hardstands	Per Mile of Road in Use
	Latrines	Per Unit
	New Construction—Lines of Communication	
	Roads	Per Mile of New Road
	Heliports	Per Heliport
	Fuel pipelines	Per Mile of New Pipeline
	Support for the Air Force	Per Engineer Manhour
	Maintenance	
21	Road Maintenance	Per Mile of Road in Use
22	Railroad Maintenance	Per Mile of Railroad in Use
23	Port Maintenance	Per STON Cargo/Eqmt Per Day

BARRIERS AND FORTIFICATIONS

FASTALS	DESCRIPTION	UNIT OF MEASURE
	Barriers	
	Triple-standard concertina	Per Division by Type
	Four-strand fence	Per Division by Type
	Fortification	
	Two-soldier fighting position	Per Division by Type
	Command post	Per Division by Type
	Mortar position with overhead	Per Division by Type
	Perimeter bunker/guard tower	Per Division by Type
	Fighting bunker	Per Division by Type
	Field artillery revetment	Per Division by Type
	Air defense revetment	Per Division by Type

The Class IV planning factors produced by this study potentially will be used in determining the availability of the hauling and handling resources that directly affect the amount of Class IV materials consumed. By their very nature, Class IV materials are bulky and difficult to transport, and they do not carry a priority for delivery that can compete with weapons, ammunition, and fuel when troops are deployed in a crisis situation. To avoid the circular reasoning that arises in linking the planning factor to the amount of materials likely to be consumed, the study will concentrate on determining what good judgement would say is the amount of Class IV materials required.

Determining "the amount of Class IV materials required" may be the best path for the study to take, but that path is not without its own hazards. The "amount required" is not a single, well-defined number, but a range of numbers whose lower bound is a level below which the shortage of Class IV supplies would seriously jeopardize the survivability of the force and the success of the mission and whose upper bound is a level above which material inventories are greater than can be fruitfully used in the time available. Each one of the factors listed in Table 2-2 causes a shift in the range of the amount required. To make the study's planning factor methodology simple enough to apply quickly and with only general information about the factors in Table 2-2, some simplifying assumptions are necessary:

- Terrain and climate/weather are assumed to be of the variety that is least demanding on Class IV requirements. Planners using the study's methodology would always adjust the computed consumption rate upward to account for bad weather or difficult terrain.

- Length of conflict is assumed to be such that construction for base development does not exceed the initial standard. Again, planners using the study's methodology would always adjust the computed consumption rate upward to account for strategies requiring more permanent construction.

- Engineer force capabilities are not considered. The planning factor methodology will produce a requirements rate and not a capabilities rate.

The planning factor methodology will attempt to account for the other factors in Table 2-2 that were not addressed in these assumptions, though admittedly at a very low resolution of detail. Obviously, a complex computer model could be constructed to produce a planning methodology that is more sensitive to the many details that affect the Class IV requirement, but the use of such a model would require an overhead of time and labor contrary to the very nature of planning

factors. The study's low resolution method, then, will necessarily sacrifice some accuracy for ease of use, a compromise very much in keeping with the nature of planning factors.

The study also made several simplifying assumptions about the Class IV materials required to perform the tasks listed in Table 2-3. Though the variety of construction methods for each task is relatively small, the weights of the materials required by each method may vary substantially. In the real world, the actual construction method is chosen only after consideration of the engineering aspects of the project. Taking this into account in the study's methodology would require too much detail information and processing. So the following assumptions regarding construction method were made:

- The task performance method for each task is chosen so that the weight of materials required is the smallest possible within accepted practice and doctrine. Planners must adjust the computed planning factor upward to account for changes in method. Bills of materials for task performance are cited in this study only to indicate how the calculations were made and to establish credibility for the Class IV tonnage requirements used.

- Only materials moving through the military transportation system will be tracked; i.e., materials used by host nation or contractors in their own task performance are not tracked, though tasks performed by host nation or contractors reduce the number of tasks required and, therefore, reduce the amount of Class IV materials required.

- Local materials (sand, gravel, crushed rock, mineral fill, etc.) are excluded from computation, but are tracked separately as a "cubic yards per soldier per day" requirement where possible.

These assumptions, along with the computational method described in this chapter, make the calculation of a Class IV requirement relatively straightforward. The calculation involves quantifying the influences of each of the remaining factors in Table 2-2. The study's approach was to generalize from the special cases studied in computing the Class IV requirements of the scenarios used in the TAA-2001 process and from the historical records associated with the Army's recent deployment during the Gulf War. These two portions of the study are described in Chapters 3 and 4.

The goal of the study is to provide a simple-to-use method for computing a good estimate of a specific contingency's Class IV requirement (in pounds per soldier per day) given a few generally known conditions regarding the forces to be

deployed, the enemy's capabilities, and the theater's infrastructure. This method is described in Chapter 5. Under the assumptions listed in this section, the study's method will produce a contingency-specific planning factor which represents an estimate that is as close as possible to a minimal Class IV requirement.

CHAPTER 3: CLASS IV REQUIREMENTS BASED ON TAA-2001 SCENARIO DATA

Introduction

This chapter addresses the calculation of Class IV supply consumption associated with the contingencies described in each of the three study scenarios used for TAA-2001. The scenarios are representative of what is being planned for possible future missions, and the data used to establish the operational conditions for these scenarios has been widely reviewed and accepted.

The methodology is based on computing the daily Class IV supply consumption using the formula:

$$\text{Total Materials Per Day} = \sum_{\text{TASK}} (M_{\text{TASK}} * N_{\text{TASK}})$$

where M_{TASK} is the material requirement for a single task of type TASK, N_{TASK} is the number of tasks of type TASK performed per day, and where the sum is taken over all of the tasks listed in Table 2-3. The data for this computation is primarily the data used during the TAA process; either data directly associated with FASTALS as input/output, or data from authoritative sources used at a higher level of detail to complement FASTALS data, or data output from combat simulations and used by FASTALS to calculate the related support requirements. The overall computation was accomplished by dividing the tasks into four sections:

1. Base development tasks in the COMMZ and corps rear area, as modeled by the FASTALS construction model,

2. Base development tasks in the corps area not included in 1 above,

3. Divisional barrier and fortification requirements, based on the combat unit data input to FASTALS, and

4. Nondivisional barrier and fortification requirements, based on the required combat support and combat service support units identified in FASTALS output.

This chapter describes the FASTALS model and the scenario data available from its input/output files. It also describes FASTALS' representation of engineer support requirements in its construction model and how the data and methods used in the construction model can be used to compute N_{TASK} for the base development portion. Later sections describe the recent work completed by the U.S. Army Engineer Strategic Studies Center (ESSC) to update the engineer workload factors that are input to the construction model and which, in the present study, are used to determine M_{TASK} for base development tasks. The ESSC workload factors are based on data from the Army Facilities Components System (AFCS), which is also described in this chapter. The barrier/fortification portion of the computation had no existing foundation upon which to build a workload factor comparable to the ESSC/AFCS data for base development. The data and underlying assumptions for barriers/fortifications were developed by the U.S. Army Engineer School and are described here. The final sections of the chapter explain how these existing data sets were used to determine the Class IV supply requirements by task and time period for each of the scenarios. The conclusion summarizes the results of the initial calculations.

Force Analysis Simulation of Theater Administrative and Logistics Support (FASTALS)

According to the *FASTALS User's Manual*, FASTALS is a computer simulation "used in force planning analyses where balanced, time-phased, geographically distributed force requirements are desired." FASTALS automates the computation of a time-phased troop list that indicates the number, type, and geographical distribution of units required to support a given combat force and its theater-related activities. The model computes support workloads pertaining to personnel, replacement, medical, materiel, maintenance, construction, and transportation.

FASTALS is part of a system of models that together represent the entire spectrum of theater operations. Outputs from the combat models regarding deployment scheduling, force structure, and combat operations become inputs to FASTALS and directly affect the cyclic computations used by FASTALS to determine the support requirements. Combat units are represented at brigade level, while support units may be as small as a squad or team. FASTALS processes data in steps of time that may vary in length, though the typical

FASTALS time step is 5 to 10 days long. The model's input data for each time period includes:

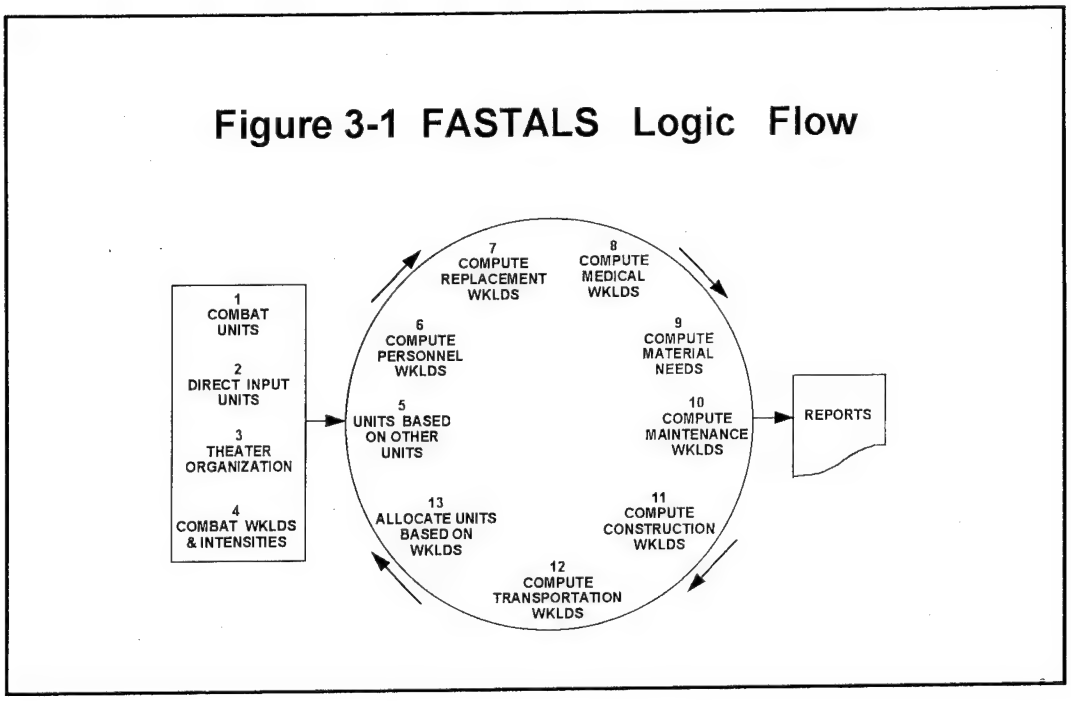
- Identity, location, and daily intensity of combat for the major ground combat units,
- Stationing of divisional and nondivisional artillery,
- Location and movement of the forward edge of battle area (FEBA),
- Types, amounts, and locations of existing facility assets available for Army use,
- Supply stockage, replacement, and buildup,
- Divisional and nondivisional supply consumption rates,
- Location and capacity of transportation network segments,
- Prisoner of war capture rates,
- Rates for wounded in action and nonbattle injuries,
- Degree of use of indigenous labor for construction (labor service and host nation support).

FASTALS achieves the geographical distribution of its computed workloads by modeling both physical and logical regions. The physical regions divide the theater into fixed geographical locations with boundaries that determine applications of rules regarding movement and sharing of resources. The logical regions consist of the six military regions: (1) division, (2) corps, (3) rear combat zone, (4) communications zone, (5) port area, and (6) offshore. During the course of the simulation, the logical regions move across the physical regions, producing variations in workloads and available assets.

FASTALS uses the input data for each region and time period in its cyclic computations of workload requirements according to the process illustrated in Figure 3-1, which is quoted from the *FASTALS User's Manual.*

These computations produce 48 different workload outputs for each time period, including:

- U.S. Army population by region,
- U.S. Army nondivisional population by region,
- STON of dry cargo and unit equipment through seaports by region,
- STON of bulk Class III supplies stored by region,
- STON of Class V supplies stored by region,
- STON of dry cargo (less Class V and VIII) stored by region,
- Enemy prisoners of war by region,
- Replacements through replacement camps per day,



- Miles of highway main supply routes in use,
- Hospital patients by region, and
- Engineer manhours expended by task and region for construction, maintenance, and repair.

The input data and the corresponding workloads computed by FASTALS together provide the information needed to determine the number of construction, maintenance, and repair tasks performed for each type of base development task during each time period in the scenario. FASTALS output data also includes a troop list by region for each time period. This list identifies each type of unit by description, standard requirement code (SRC), and strength. This data, together with the general scenario description, are sufficient to reconstruct the composition, growth, and movement of the force over time; all of which are needed for the barrier/fortification requirements.

The Engineer Representation in FASTALS

FASTALS was designed to model the construction effort of the combat heavy engineer units working behind the corps boundary, but it is flexible enough to allow workloads in specific tasks to extend as far forward as study guidance requires. The engineer portion of FASTALS does not track the consumption of the Class IV materials that would be associated with the workloads; it tracks only the manhours expended on each task. Other parts of the model that need an estimate of Class IV consumption rely on the current planning factor. This method is used,

for example, in computing storage and haul requirements for Class IV in the logistics and transportation sections. Ideally, the Class IV supply requirement should be directly related to the specific engineer workloads computed in the engineer section of the model, but that is not the case. (NOTE: One of the significant conclusions of this study is that the lack of a direct interface between the construction model and the logistics and transportation models may actually lead to a self-predicting Class IV planning factor. This concept will be discussed in more detail in Chapter 4, which discusses relevant aspects of current engineer practice and observations concerning the data from Operation Desert Storm.)

FASTALS computes the engineer manhours required for each base development task by time period and region using one of three algorithms depending upon the type of task: LOC damage repair, LOC maintenance, and construction and repair of facilities. The three algorithms have the same basic structure, which is very similar to the materials algorithm:

$$\text{Total Manhours Per Day} = \sum_{TASK} (MH_{TASK} * N_{TASK})$$

where, in this case, MH_{TASK} is the number of manhours required per task of type TASK. The three algorithms used for computing the manhour requirements differ only in the way in which N_{TASK} is determined. The FASTALS data includes enough information to determine N_{TASK} for each task during each simulated time period.

Computation of N_{TASK}, the number of tasks of type TASK performed per day, depends first on the associated workload for the task. For tasks involving roads, for example, the basic associated workload is the number of miles of road in use. For general storage, it is the number of short tons of supplies to be stored. For hospital construction and repair, it is the number of wounded in action and nonbattle injuries. In Table 2-3, the column labeled "UNIT OF MEASURE" indicates each task's associated workload. These workloads are tracked across regions and time periods, and the totals are output from FASTALS in the form of tables. The computation of N_{TASK} also varies according to the type of task as follows:

1. LOC damage repair:

$$N_{TASK, PERIOD} = W_{TASK, PERIOD} * PD_{PERIOD-1} * PC_{TASK, PERIOD} \div L_{PERIOD}$$

2. Facility construction and repair:

$$N_{TASK,\ PERIOD} = ([1 - HN_{TASK}]\ [\ (W_{TASK,\ PERIOD} - AF_{PERIOD-1}) * PC_{TASK,\ PERIOD} + .5 * (W_{TASK,\ PERIOD} - AF_{PERIOD-1}) * PC_{TASK,\ PERIOD} * PD_{PERIOD}] + (AF_{PERIOD-1} * PD_{PERIOD-1})) * \div L_{PERIOD}$$

3. LOC maintenance:

$$N_{TASK,\ PERIOD} = W_{TASK} * PC_{PERIOD}$$

where: $N_{TASK,\ PERIOD}$ = number of TASKs performed per day during time PERIOD,

$W_{TASK,\ PERIOD}$ = total workload associated with TASK during time PERIOD,

AF_{PERIOD} = accumulated facilities existing in time PERIOD,

PD_{PERIOD} = percent damage inflicted during PERIOD,

$PC_{TASK,\ PERIOD}$ = percent of actual work completed with troop labor on TASK during time PERIOD, and

HN_{TASK} = percent of work performed by host nation support

L_{PERIOD} = the length in days of time PERIOD.

Note that these computations are applied on a region-by-region basis, with considerable variation occurring in the accumulated facilities and workloads because of the ebb and flow of the FEBA.

These algorithms for computing the number of tasks of each type performed per day within a FASTALS time period require quite a bit of data and quite a few calculations to move from one time period to the next. This is especially true for tracking the accumulated facilities on a region-by-region basis. Except for $W_{TASK,PERIOD}$, which is a FASTALS output for most tasks, all of these data elements are part of FASTALS input. Of these, all but the length of a time period are data elements that are constructed and staffed through the engineer community; either through the Office of the Assistant Chief of Engineers in the Pentagon or through the U.S. Army Engineer School at Fort Leonard Wood, MO. During the current

study, Microsoft EXCEL® was used to build spreadsheets to manage the application of these algorithms to the data for each of the scenarios to compute the number of tasks of each type performed per day during each time period. The computation provides one of the two components of the daily total materials calculation—N_{TASK}. The other component of the calculation, the materials required for a single task for each type of task (M_{TASK}), was determined by using a recent report by the Engineer Strategic Studies Center documenting their effort to update FASTALS input regarding the manhours required for a single task of each type.

Army Facilities Components System and the Engineer Workload Factors

This section describes the derivation of M_{TASK}, the weight of materials required to perform a single unit of a base development task of type TASK. The starting point is to examine how construction is accomplished in a theater of war. The processes used in the design and construction of facilities needed to support military operations have a different emphasis than those used by commercial organizations. Facilities are simple and austere, designed to provide the needed functionality for 2 years or less, to use expedient construction methods, and to require only easily procured, standard materials. The Army's theater construction follows the principle of minimality: use the least time, resources, and expense possible to accomplish the mission. In the environment of a theater of operations, the construction planning and management process works best when applied to a set of standard facilities whose designs, labor/equipment/material requirements, and work breakdowns are planned well in advance. The AFCS makes this possible.

The AFCS provides design information for the standard facilities required to support theater operations. It includes the elementary construction, logistics, and planning data commonly needed by military planners, supply agencies, and construction personnel at all levels, from strategic to operational. The AFCS also provides facility designs and data for four different climates (temperate, tropical, frigid, desert) and two building standards (initial and temporary). Each facility in the AFCS has a set of data associated with it: AutoCAD® designs; a list of its subfacility components down to the bill of materials (BOM) required for construction; the labor and equipment estimate (LEE) in terms of military occupational specialty (MOS), horizontal equipment, and general manhours; and theater-oriented guide specifications (TOGS).

Huntsville Division, U.S. Army Corps of Engineers, is responsible for building and maintaining the required AFCS design documents and supporting databases, which are published in Technical Manuals 5-301, 5-302, and 5-303. In recent years, this data has been digitized for use on a personal computer with commercial

software packages, namely AutoCAD® for the designs and the dBase® Database Management System for the associated data. Huntsville Division updates the electronic files yearly and works continuously to ensure that the facilities in AFCS represent the current doctrine, operational requirements, and construction practices of the military engineering community.

In a 1992 study, the ESSC used detailed AFCS labor and equipment estimates to calculate new workload factors for use in FASTALS (ESSC report CETEC-ES-R-92-4). In the basic formula mentioned earlier in this chapter:

$$\text{Total Manhours Per Day} = \sum_{\text{TASK}} (MH_{TASK} * N_{TASK})$$

these workload factors are represented by the key element MH_{TASK}, the manhours expended per task of type TASK. In the course of their study, ESSC very carefully documented a process for linking the manhours for task performance in FASTALS with actual facilities in AFCS. Moreover, the process documented in the ESSC report outlines assumptions made about each task for construction in Europe, northeast Asia (NEA), and southwest Asia (SWA) and translates the manhours per facility into the manhours per unit of measure used by FASTALS for the workload calculation. To maintain data consistency, the current study used the task assumptions, associated AFCS facilities, and workload factors computations from the ESSC report to determine the materials requirement per task M_{TASK} for each FASTALS task.

The method used for the current study to determine the material requirement M_{TASK} for each task was to apply the same linear combination of facility requirements used in the ESSC study to compute MH_{TASK}, substituting each facility's material requirements for each facility's manhour requirements in the computation. For example, the ESSC report identified the use of three AFCS facilities for road damage repair in Europe: 11100CE for crater repair, 85290AM for culvert repair, and 85110BN for road surface work. Let MH_{CRATER}, $MH_{CULVERT}$, and MH_{ROAD} represent the AFCS manhour requirements for each corresponding facility. The ESSC assumptions regarding the task of road damage repair in Europe were: 30 percent of road damaged by craters, 15 percent of culverts rehabilitated, and 6 inches of aggregate needed for the entire road surface. The corresponding ESSC calculation to determine the manhours per mile of road repair was:

$$MH_{TASK} = 0.3 * MH_{CRATER} + 0.15 * MH_{CULVERT} + 1 * MH_{ROAD}$$

The current study used the AFCS database to determine the weight of materials in each facility's bill of materials (M_{CRATER}, $M_{CULVERT}$, and M_{ROAD}) and substituted these numbers for the corresponding manhours to determine the material requirement:

$$M_{TASK} = 0.3 * M_{CRATER} + 0.15 * M_{CULVERT} + 1 * M_{ROAD}$$

Appendix A contains a complete list of the AFCS facilities for each of the FASTALS tasks, along with the manhour and material tonnages required to complete it.

Class IV Requirement for Base Development (COMMZ)

Initial Calculation

The preceding two sections described the study's data sources and methods for determining the two major components of the algorithm for calculating the base development portion of the daily consumption of Class IV supplies:

$$\text{Total Materials Per Day} = \sum_{TASK} (M_{TASK} * N_{TASK})$$

As mentioned earlier, the FASTALS model itself does not track the Class IV supplies needed to support the engineer workloads; it tracks only the manhour requirements. To calculate the daily materials requirement by task, two spreadsheet models were constructed. The first used FASTALS engineer input and workload output by time period and region to calculate the number of tasks performed (i.e., N_{TASK}) for each of the time periods in each of the studies. This spreadsheet was verified by using the manhours per task determined by the ESSC study in the algorithm:

$$\text{Total Manhours Per Day} = \sum_{TASK} (MH_{TASK} * N_{TASK})$$

to replicate the engineer workload output table from FASTALS. Except for minor round-off discrepancies, these calculations matched the FASTALS output for all but seaport maintenance. The study used the FASTALS engineer workload to determine the material requirement for seaports, though the study's calculation showed that the workload was considerably larger for this task than the output indicated. A second spreadsheet model was constructed to determine the material requirements for each task (i.e., M_{TASK}) using the ESSC methodology. This

spreadsheet was verified by substituting the manhour requirements data into the spreadsheet and replicating the published numbers derived in the ESSC study. Again, except for minor round-off discrepancies, the study was able to match the ESSC manhour calculations for all but two tasks: highway bridge damage repair in SWA and enemy prisoner of war (EPW) camp construction. In the case of highway bridge damage repair, the difference did not affect the material requirements for the task. In EPW camp construction, data from the AFCS database indicated that the facilities identified in the ESSC workload factors for a 500-man camp were more in line with the requirement for a 2000-man camp. The current study reduced the EPW camp requirement to a quarter of the FASTALS workload to determine the material requirement.

The FASTALS model does not completely compute the engineer workload. Funds have not been available to correct several known problems in FASTALS, so study personnel routinely correct the model results by hand for each of these areas. Data for these offline corrections was not available for the current study. To adjust the workloads for these areas, the current study combined the results of its own workload model with expert opinion. These areas are:

- Airfield damage repair (Task 7). Some confusion exists about the unit of measure for airfield damage repair. The *FASTALS User's Manual* requires the engineer manhours to be based on a "per plane" requirement while the ESSC study and the AFPDA uses "per airfield" as the unit of measure. The model's workload calculation is zeroed out. FASTALS also does not specifically track support to the Air Force, though the engineer manpower commitment can be included as a precalculated requirement. Experts indicated that airfield work other than damage repair (providing hardened shelter for aircraft and maintenance facilities; expansion of runways, parking areas, and taxiways; and aircraft revetments) is a primary engineer mission. The original study documentation sent to the 412th and 416th ENCOMs did not contain workloads or materials for airfields. The addition of that effort to the revised material requirements calculations made a substantial difference in the final consumption rate. The study's methodology for adding airfields is discussed in the next section.

- Refrigerated storage construction (Task 12). Task 12 is another task in which the workload factor and unit of measure are ambiguously stated. In this case, however, sufficient data existed from the ESSC study and the FASTALS input data to compute a workload and material requirement for refrigerated storage construction consistent with AFPDA assumptions. All of the input data was based on the nondivisional

population, and the study algorithm used was consistent with other construction tasks. While the engineer workload outputs for FASTALS have a zero workload for Task 12, the study workload has been computed and considered in the supply consumption rate.

- Air defense artillery (ADA) site construction (Task 15). The ESSC study substituted this task for stockade construction in an effort to update the type of tasks engineers are most likely to perform. Funds were not available, however, to adjust the FASTALS model to accept this new task. ADA site construction is considered a combat support task. The current study addressed this problem by including ADA site preparation as a part of the barrier/fortification plan, with materials for revetments, concertina, personnel protection, and latrines.

- Road hardstand construction (Task 20). This task is similar to the previous task. The ESSC study substituted this task for pipeline maintenance. The FASTALS model output did not calculate a workload for Task 20. In this case, however, the workload was the number of miles of road in use, data that was available from FASTALS output for other engineer tasks involving roads. This data was used in the study's spreadsheet model to compute the workload and material requirements.

Each of the daily materials requirements by task for each time period of a study scenario was accumulated to produce the total daily materials requirement during each time period. These accumulations are given in a tabular format in Appendix B for Europe, Major Regional Contingency-West (MRCW), and Major Regional Contingency-East (MRCE). For comparison, the results of altering the workload data to agree with the recommendations of subject matter experts (described below) are interleaved with the original tables.

Subject Matter Expert Input for Base Development Calculations

The initial calculations of the consumption rates for base development materials were completed using the input data and output workloads from the FASTALS TAA-2001 study sets (Table 3-1). While the initial findings provide a firm foundation, the study went one step further to ensure that the data and processes were consistent with current doctrine and practice and reflect real-world experience. The 412th and 416th Engineer Commands were asked to consider the

Table 3-1
Manhour and Class IV Requirements - FASTALS Base Development Tasks
Original Study Data for 23 FASTALS Tasks

TASK SPECIFICATIONS			EUROPE		NORTHEAST ASIA		SOUTHWEST ASIA	
TASK	DESCRIPTION	UNIT OF MEASURE	MANHOURS	SHORT TONS	MANHOURS	SHORT TONS	MANHOURS	SHORT TONS
1	Road damage repair	Per mile repaired	344.70	0.92	367.80	1.85	459.75	1.85
2	Highway bridge damage repair*	Per mile repaired	421.90	26.50	493.00	26.52	557.00	26.51
3	Railroad damage repair	Per mile repaired	6570.00	0.00	6570.00	0.00	8212.50	0.00
4	Railroad bridge damage repair	Per mile repaired	1725.00	37.97	4600.00	101.24	2875.00	50.62
5	Pipeline damage repair	Per mile repaired	694.83	3.06	694.83	3.06	488.93	11.92
6	Port damage repair	Per ston per day thru	2.43	0.03	2.43	0.03	3.04	0.03
7	Army Airfield damage repair	Per airfield repaired	4889.00	548.23	4889.00	548.23	6111.25	548.23
8	Troop camp construction	Per nondivisional soldier	6.76	0.04	10.42	0.08	13.03	0.08
9	Admin space construction	Per nondivisional soldier	0.81	0.01	0.81	0.01	0.96	0.01
10	General supply storage construction	Per ston stored	1.14	0.03	1.14	0.03	1.43	0.03
11	Ammunition storage construction	Per ston stored	7.89	0.05	21.34	0.09	26.68	0.09
12	Refrigerated storage construction	Per theater soldier	0.26	0.00	0.26	0.00	0.33	0.00
13	POL storage construction	Per ston stored	1.84	0.01	1.84	0.01	2.30	0.01
14	EPW camp construction	Per EPW	25.68	0.25	25.68	0.25	32.10	0.25
15	ADA site preparation	Per missile	958.93	5.15	958.93	5.15	1198.66	5.15
16	DEPMEDs site preparation	Per patient in COMMZ	34.55	0.13	34.55	0.13	43.19	0.13
17	Dispensary/dental clinic construction	Per soldier in COMMZ	0.19	0.01	0.19	0.01	0.23	0.01
18	Maintenance facility construction	Per soldier in COMMZ	0.99	0.01	0.99	0.01	1.24	0.01
19	Replacement camp construction	Per replacement	11.25	0.07	15.61	0.11	20.59	0.13
20	Road hardstand construction	Per mile of road	46.22	0.79	46.22	0.79	28.88	0.27
21	Road maintenance	Per mile per day	2.80	0.00	2.80	0.00	3.50	0.00
22	Railroad maintenance	Per mile per day	3.00	0.00	3.00	0.00	3.75	0.00
23	Port maintenance	Per ston per day thru	0.24	0.00	0.24	0.00	0.30	0.00

*This workload does not agree with the ESSC data for SWA.

processes described in the preceding sections and to suggest refinements on the basis of the concerns described below.

Staff from the engineering and logistics sections at the 412th and 416th ENCOMs were given copies of all of the spreadsheet tables used in the materials calculations, descriptions and bills of material for the AFCS facilities used to determine the manhour and material requirements, and copies of the ESSC FASTALS work factors report. They were asked to examine the data and processes with the following questions in mind:

- Do the 23 tasks represented in FASTALS account for the significant consumers of Class IV supplies?
- Are the ESSC assumptions about each of the tasks reasonable?
- Are the facilities associated with each of the tasks consistent with current practices?
- Are the bills of materials for the facilities representative of the supplies that would be available in each area of operations (AO)?
- Are the data elements associated with the workloads (percent damage, percent of work accomplished with troop labor, forwardmost regions for task performance, amount of existing facilities) consistent with experience?
- Are the resulting manhour and material commitments consistent with the priorities of standard construction policy?
- Are the manhour commitments realistic in light of the Army's shrinking forces?

Feedback from the 412th and 416th ENCOMs included the following points:

- Current OPLAN preparation with the Joint Engineering Planning and Execution System (JEPES) uses the Joint Chiefs of Staff (JCS)-mandated Logistical Sustainability Analysis (LSA) categories for sustainment engineer work. The six categories are: (1) airfields, (2) petroleum, oils, and lubricants (POL) storage and distribution, (3) non-POL storage, (4) troop support, (5) utilities, and (6) seaports. These categories correspond to FASTALS tasks 7, 13, 5, 10, 11, 12, 8, 16, 17, 18, 19, 6, 23. With the exception of ADA site construction, the

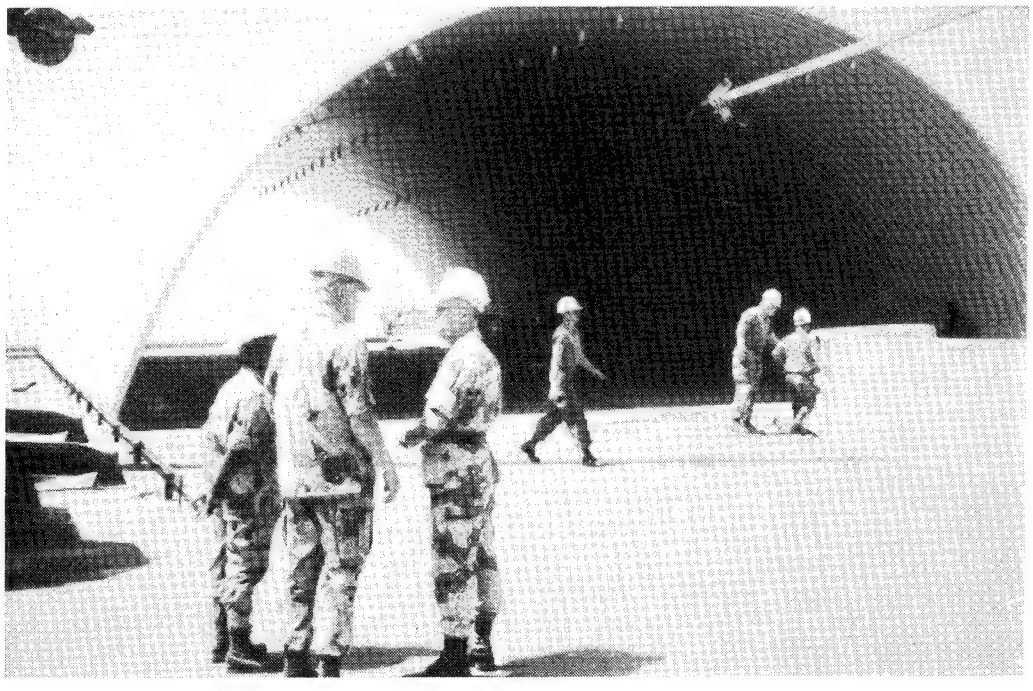
remaining tasks are expected to be accomplished with host nation or contractor support.

• The current building of choice for facility construction is a light-weight metal structure known as K-Span. In AFCS, this building is listed as a rapidly-erectable, lightweight mobilization structure (RELMS). This mode of construction was used during the Gulf War with great success (Figure 3-2). Large structures using stretched fabric, known as clamshells, are also an option. Both of these newer methods for providing facilities offer faster construction times and require materials that are lighter than comparable wood-frame or preengineered metal structures.

• Both ENCOMs questioned the requirement for construction of facilities, especially of the type chosen for the FASTALS workloads, for maintenance, clinics, and administration. Their assumption is that facilities will generally be available through host nation assets or leasing or that tents will be used as an alternative. The 416th suggested that if maintenance facilities were required, K-Span buildings should be used.

• Original pipeline construction, where required, would use the Inland Pipeline Distribution System. POL storage would use collapsible tanks.

Figure 3-2 A K-Span Building



• Both ENCOMs expressed concern for the lack of data regarding airfield construction and damage repair. The data they were given for examination indicated no requirement. To account for this omission, the current study used an estimated engineer manhour requirement consistent with study guidance and computed a material requirement for airfield work in terms of the number of pounds of Class IV materials expended per manhour of work. To determine this rate, the following assumptions were made:

– Engineer Army airfield work and work in support of the Air Force consists of the following activities requiring the given percent of the total time devoted to airfield tasks:

· General site clearance and preparation requiring only local materials (60%)
· Damage repair (15%)
· Construction and hardening of maintenance facilities (5%)
· Construction of aircraft revetments (10%)
· Construction of aircraft parking aprons and taxiways (5%)
· Assault runways for C-130 (5%)

– Each engineer activity has an associated material requirement determined by dividing the pounds of material required for a single task by the number of manhours required to complete the task. Sample facilities were chosen from AFCS (on the low side of material requirements) to assign the following consumption rates:

· General site clearance and preparation: 0 lb/mh
· Damage repair: 420 lb/mh using ESSC task 7
· Maintenance facilities: 233 lb/mh using AFCS facility 93170AU
· Aircraft revetments (Air Force design): 570 lb/mh using 14902FB
· Aircraft parking aprons and taxiways (asphalt): 1174 lb/mh using AFCS facility 11310CE
· Runway for C-130 (landing mat/membrane): 264.6 lb/mh using AFCS facility 11110BA

– Applying the breakdown of an hour's work according to the percent of effort in the first assumption to the appropriate rate of consumption in the second assumption yields an aggregate hourly consumption of:

$$.6*0 + .15*420 + .05*233 + .1*570 + .05*1174 + .05*264.6 = 203.6 \text{ lb/mh}$$

The changes suggested by the 412th and 416th ENCOMs were made by substituting the appropriate tonnages for the new facilities in place of the original facility requirements in the study's spreadsheets. The changes affected construction of general supply storage, POL storage, clinics, and maintenance facilities as well as the addition of airfields to the task list. Table 3-2 contains adjusted Class IV requirements for each task and scenario (changes were not made in the corresponding task manhour requirements). Appendix C contains the comprehensive facility list, with the changed facilities highlighted for comparison to the original list given in Appendix A. Applying the newly computed material weights for each task to each of the scenarios produced a substantial difference in the final material requirement. This can be noted by examining the adjusted tabulations interleaved with the original tables that had been given to the ENCOMs (Appendix B).

Summary of the Class IV Requirement for Base Development (COMMZ)

Tables 3-3 and 3-4 summarize the results of the calculations and adjustments described in the preceding sections for base development in the COMMZ.

Class IV Requirements for Base Development (Corps)

Though FASTALS does not calculate an engineer base development workload for the corps area, the input/output data does contain enough information to apply the methods described in the preceding sections to calculate the material requirement. The workload was computed only for the following tasks: road maintenance and damage repair, storage facility construction and repair (dry cargo, ammunition, POL), DEPMEDs construction, and EPW camp construction. Heliports and latrines for the corps area were included in the barrier fortification calculations described below. The ESSC workload factors were used again since they represented the extremely austere construction methods suitable for the corps area. Also the original FASTALS assumptions regarding the levels of effort and damage for each task were applied to work in the corps area. Workloads and existing facilities were taken from FASTALS data for the physical regions corresponding to the corps area. Finally, the algorithms used by FASTALS to calculate the engineer workload were applied to this set of data to determine the base development requirement in the corps area. The tabular results of this computation are given in Appendix D and summarized in Table 3-5.

Table 3-2
Manhour and Class IV Requirements - FASTALS Base Development Tasks
Adjusted to Include Airfields and Recommended Changes in Facilities

TASK SPECIFICATIONS			EUROPE		NORTHEAST ASIA		SOUTHWEST ASIA	
TASK	DESCRIPTION	UNIT OF MEASURE	MANHOURS	SHORT TONS	MANHOURS	SHORT TONS	MANHOURS	SHORT TONS
1	Road damage repair	Per mile repaired	344.70	0.92	367.80	1.85	459.75	1.85
2	Highway bridge damage repair*	Per mile repaired	421.90	26.50	493.00	26.52	557.00	26.51
3	Railroad damage repair	Per mile repaired	6570.00	0.00	6570.00	0.00	8212.50	0.00
4	Railroad bridge damage repair	Per mile repaired	1725.00	37.97	4600.00	101.24	2875.00	50.62
5	Pipeline damage repair	Per mile repaired	694.83	3.06	694.83	3.06	488.93	11.92
6	Port damage repair	Per STON per day thru	2.43	0.03	2.43	0.03	3.04	0.03
7	Army Airfield damage repair	Per airfield repaired	4889.00	548.23	4889.00	548.23	6111.25	548.23
8	Troop camp construction	Per nondivisional soldier	6.76	0.04	10.42	0.08	13.03	0.08
9	Admin space construction	Per nondivisional soldier	0.81	0.01	0.81	0.01	0.96	0.01
10	Gen supply storage construction	Per STON stored	1.14	0.01	1.14	0.01	1.43	0.01
11	Ammunition storage construction	Per STON stored	7.89	0.05	21.34	0.09	26.68	0.09
12	Refrigerated storage construction	Per theater soldier	0.26	0.00	0.26	0.00	0.33	0.00
13	POL storage construction	Per STON stored	1.84	0.01	1.84	0.01	2.30	0.01
14	EPW camp construction	Per EPW	25.68	0.25	25.68	0.25	32.10	0.25
15	ADA site preparation	Per missile	958.93	5.15	958.93	5.15	1198.66	5.15
16	DEPMEDs site preparation	Per patient in COMMZ	34.55	0.13	34.55	0.13	43.19	0.13
17	Dispensary/dental clinic construction	Per soldier in COMMZ	0.19	0.00	0.19	0.00	0.23	0.00
18	Maintenance facility construction	Per soldier in COMMZ	0.99	0.02	0.99	0.02	1.24	0.02
19	Replacement camp construction	Per replacement	11.25	0.07	15.61	0.11	20.59	0.13
20	Road hardstand construction	Per mile of road	46.22	0.79	46.22	0.79	28.88	0.27
21	Road maintenance	Per mile per day	2.80	0.00	2.80	0.00	3.50	0.00
22	Railroad maintenance	Per mile per day	3.00	0.00	3.00	0.00	3.75	0.00
23	Port maintenance	Per STON per day thru	0.24	0.00	0.24	0.00	0.30	0.00
	Airfields	Per engineer manhour	1.00	0.09	1.00	0.09	1.00	0.07

*This workload does not agree with the ESSC data for SWA.

Table 3-3 COMMZ Base Development Data for TAA-2001 Scenarios
Includes 23 Modeled Tasks Only

CONSUMPTION RATES	UNITS	EUROPE	MRCW	MRCE
Average by 10-day Period - All Materials	lb/person/day	10.88	3.37	6.47
Average by 10-day Period - Class IV Materials	lb/person/day	2.47	2.00	4.16
Average by 10-day Period - Local Materials	cy/person/day	1.61	0.99	1.85
Even Distribution - All Materials	lb/person/day	10.31	3.02	4.62
Even Distribution - Class IV Materials	lb/person/day	2.50	1.88	3.38
Even Distribution - Local Materials	cy/person/day	1.53	0.89	1.49

ADDITIONAL DATA	UNITS	EUROPE	MRCW	MRCE
Final Total Population	person	598,323	252,275	435,234
Average Daily Population	person	555,020	161,424	298,251
Total Number of Days (C-Day to End)	day	35	140	115
Total Materials Consumed	lb	200,298,121	68,170,926	158,308,502
Total Class IV Materials Consumed	lb	48,528,374	42,572,078	115,868,400
Total Local Cube Consumed	cubic yard	29,668,033	20,093,280	50,976,367

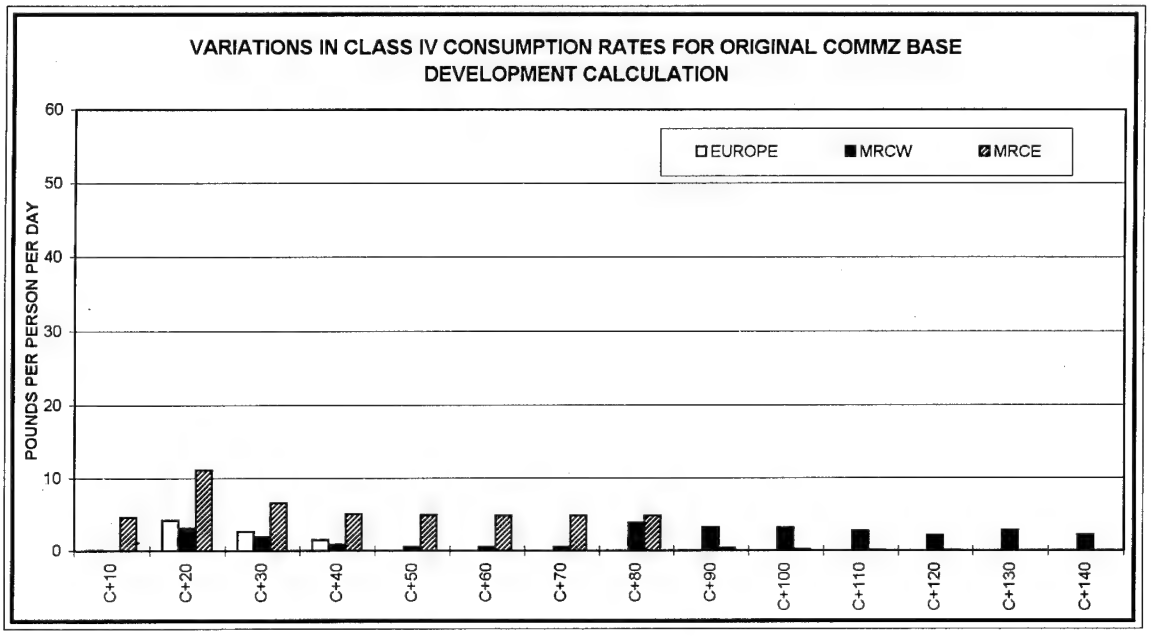


Table 3-4 COMMZ Base Development Data for TAA-2001 Scenarios
After Addition of Airfields and Recommended Changes in Facilities

CONSUMPTION RATES	UNITS	EUROPE	MRCW	MRCE
Average by 10-day Period - All Materials	lb/person/day	10.08	8.46	13.94
Average by 10-day Period - Class IV Materials	lb/person/day	3.70	6.39	10.66
Average by 10-day Period - Local Materials	cy/person/day	1.61	0.99	1.87
Even Distribution - All Materials	lb/person/day	9.56	7.57	10.80
Even Distribution - Class IV Materials	lb/person/day	3.68	5.72	8.71
Even Distribution - Local Materials	cy/person/day	1.53	0.10	1.50

ADDITIONAL DATA	UNITS	EUROPE	MRCW	MRCE
Final Total Population	person	598,323	252,275	435,234
Average Daily Population	person	555,020	161,424	298,251
Total Number of Days (C-Day to End)	day	35	140	115
Total Materials Consumed	lb	185,717,258	171,187,962	370,378,965
Total Class IV Materials Consumed	lb	71,481,471	129,286,759	298,790,898
Total Local Cube Consumed	cubic yard	29,744,144	2,261,603	51,538,649

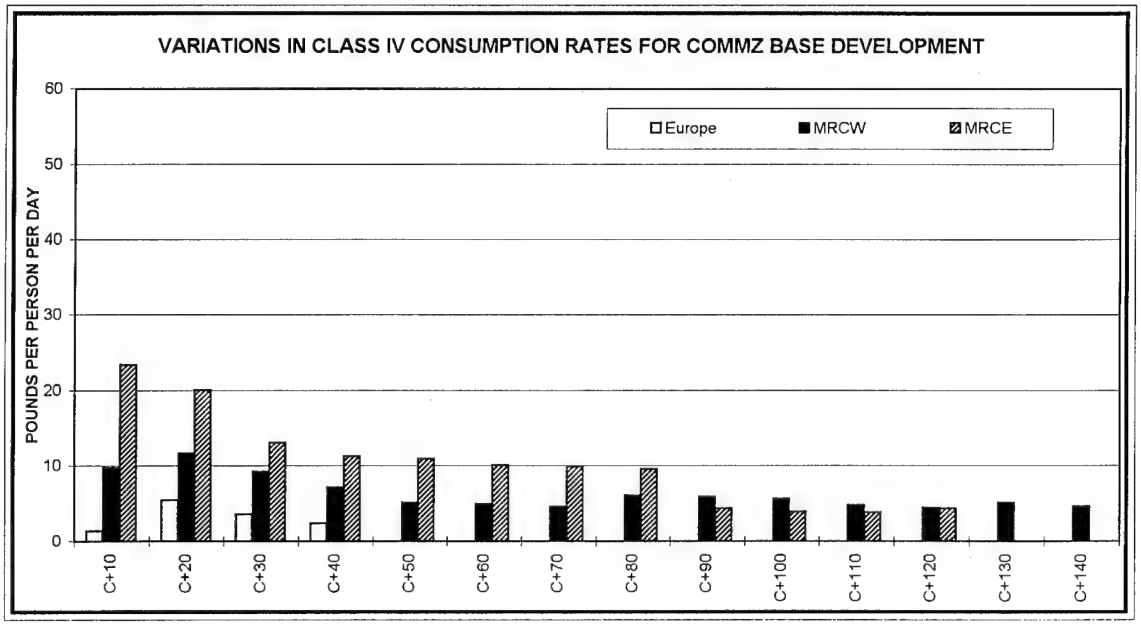
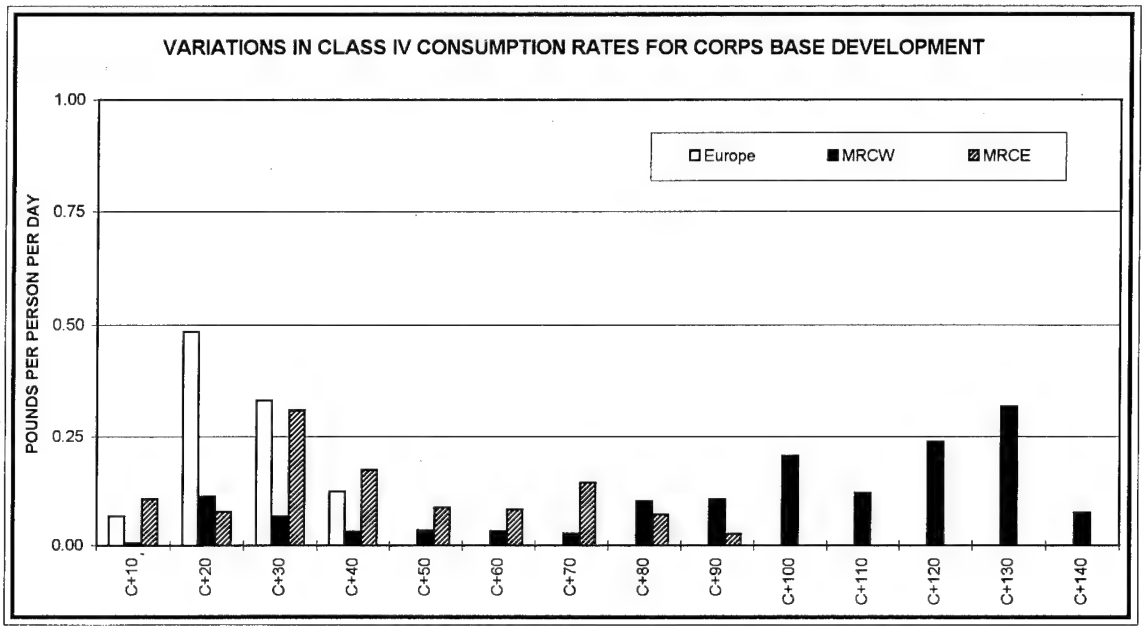


Table 3-5 Corps Base Development Data for TAA-2001 Scenarios

CONSUMPTION RATES	UNITS	EUROPE	MRCW	MRCE
Average by 10-day Period - All Materials	lb/person/day	1.30	0.12	0.15
Average by 10-day Period - Class IV Materials	lb/person/day	0.29	0.11	0.05
Average by 10-day Period - Local Materials	cy/person/day	0.19	0.06	0.05
Even Distribution - All Materials	lb/person/day	1.20	0.14	0.12
Even Distribution - Class IV Materials	lb/person/day	0.29	0.13	0.08
Even Distribution - Local Materials	cy/person/day	0.18	0.07	0.04

ADDITIONAL DATA	UNITS	EUROPE	MRCW	MRCE
Final Total Population	person	598,323	252,275	435,234
Average Daily Population	person	555,020	161,424	298,251
Total Number of Days (C-Day to End)	day	35	140	115
Total Materials Consumed	lb	23,319,680	3,101,209	4,182,529
Total Class IV Materials Consumed	lb	5,640,499	2,856,280	2,723,226
Total Local Cube Consumed	cubic yard	3,401,492	1,641,500	1,321,171



Divisional Class IV Requirement for Barriers and Fortifications

The FASTALS model focuses on computing the support requirements for combat and does not directly represent the combat itself. The input data for FASTALS, however, includes a description of the number and types of divisional and brigade-level combat units being supported, as well as their location, intensity of combat, and strength during each time period. FASTALS output, in turn, documents not only the combat units but also all of the supporting units required during each time period. This data is sufficient to establish a basis for computing N_{TASK} for barriers/fortifications (B/F). A corresponding M_{TASK} similar to the ESSC study results for base development had to be developed during the course of the current study.

Given the level of aggregation required for the current study, the approach was to determine the B/F requirements of a divisional level unit. Engineer experts agreed that each of the different types of divisions (armor, mechanized, infantry (light), airborne, and air assault) should have different Class IV B/F requirements. For example, infantry divisions use extensive amounts of Class IV materials to protect dismounted troops, while armor divisions require weapon system protection that involves more digging than consuming of supplies. Divisional level planning staffs tend to plan B/F activities on the basis of the details of the specific situation using the time and materials available. Their approach is not one of "what do we require" but one of "what can we do with what we have." Corps planners, on the other hand, function in a "push" mode with regard to the amount and type of supplies required by subordinate divisions. Corps planners have the better perspective of a division's Class IV supply requirements, so the study established points of contact on the engineer planning staffs associated with I Corps, III Corps, and XVIII Airborne Corps.

Initial discussions with the corps planners indicated that their planning methods depended on knowing quite a bit about the METT-T (mission, enemy, troops, terrain and weather, time available) of a particular scenario before a supply requirement could be determined. As more information passed back and forth, however, a consensus grew that some general rules could be made about divisional B/F requirements. The consensus grew from the acknowledgement that units basically follow the same B/F plan if time and materials allow, no matter if they are attacking or defending and, for the most part, even if the enemy's indirect fire abilities vary from modest to substantial. The crucial factor in determining the Class IV B/F requirement is unit movement. If a unit stays in one place for more than 3 to 5 days and has time to devote to establishing a position, it will consume its maximum in Class IV supplies.

Given this easily applied rule of thumb, the study's effort turned to determining the Class IV requirement for a single unit location for each type of Army unit. With this information, the requirements for a division or separate brigade/ regiment could be rolled up from the detail associated with its component units. Rolling up the requirements was accomplished by accumulating three sets of data: (1) representative individual B/F emplacements, (2) standard division organization structures, and (3) the B/F emplacement requirements of each unit in each structure.

Individual B/F Emplacements

Engineer field manuals FM 5-102 (*Countermobility*), FM 5-103 (*Survivability*), and FM 5-34 (*Engineer Field Data*) contain descriptions of the individual barriers and fortified positions that might be used. These descriptions usually include the construction details and bills of material. The study chose representative survivability positions for individuals, command posts, groups of individuals (bunkers), major weapons systems (field artillery, air defense, mortars), and a bunker that could serve as a guard tower or as a perimeter bunker under different construction methods. Countermobility tasks are represented by the triple standard concertina, the four-strand barbed wire fence, and a block of materials for engineer-emplaced obstacles. The triple standard concertina appears to be the standard approach to blocking access or protecting a perimeter. Unlike other barbed wire barriers, concertina is relatively easy to install, is quite effective, and can be recovered and moved with the unit. The materials for engineer-emplaced obstacles are based on a representative requirement of materials yielding a stock of approximately 10 tons of material for use by an engineer company. Finally, two construction emplacements were added: forward area heliports and field latrines. Though these are not B/F emplacements, they were included to simplify the calculations. Ultimately, the study considered the Class IV planning factor from the perspective of divisional and nondivisional requirements. Including these construction tasks here resulted in a complete divisional requirement. The bills of material for each of the representative emplacements are given in Table 3-6. Note that these material requirements were chosen to be a minimal set of standard supplies. Multiple methods for constructing each type of emplacement may be used in practice; the representative bill of materials is, weight-wise, at the low end of the scale. To account for material reuse, Table 3-6 also includes a column to indicate the percent of each type of material that is likely to be recovered for future locations. After the first location, requirements for future locations are reduced by the appropriate reuse factor (represented by the unit materials requirement for "subsequent positions").

Table 3-6 Specifications for Divisional Emplacements Requiring Class IV Materials

CLASS IV MATERIALS				UNITS OF EACH TYPE OF CLASS IV MATERIAL REQUIRED[1]											
DESCRIPTION	UNIT WEIGHT (LB)	UNIT OF ISSUE	PERCENT REUSABLE	TRIPLE STANDARD CONCERTINA	FOUR STRAND FENCE	COMMAND POST	2-MAN POSITION WITH COVER	FIGHTING BUNKER	PERIMETER BUNKER/TOWER	MORTAR POSITION WITH OVERHEAD	OBSTACLE MATERIALS	FIELD ARTILLERY REVETMENT	AIR DEFENSE REVETMENT	HELIPORT	LATRINE
NAILS	1.00	LB	0.00			3		3	75						54
LUMBER	2.68	BF	0.50			384	86	384	3308	86	500			44	2885
PLYWOOD 3/4IN 4X8FT SHEET	68.00	SH	0.50			16	1	16	32	1					26
BARBED WIRE	95.00	SL	0.00	4	7						32			6	
METAL FENCE POST (LONG)	10.00	EA	0.80	160	100						640		50	294	
METAL FENCE POST (SHORT)	4.90	EA	0.80	4	2						176			12	
BARBED TAPE CONCERTINA - 50FT	37.50	RO	0.80	60							240			71	
SAND GRID - 8 X 12 FT	105.00	EA	0.20										70		
SAND BAGS	22.00	HD	0.70			11	1	11	8	3	5	104			2
STEEL CULVERT	10.00	FT	0.10											1084	
MISCELLANEOUS	1.00	EA	0.00	3					90				265	40785	1841
TOTAL WEIGHT (LB) OF MATERIALS FOR ORIGINAL LOCATION				4253	1675	2362	320	2362	11382	364	20752	2288	8115	57974	11439
TOTAL WEIGHT (LB) OF MATERIALS FOR SUBSEQUENT LOCATION				1157	867	1134	156	1134	5739	169	6995	686	6245	52302	6658

[1] Material requirements for each type of emplacement are taken from the following sources:

Triple Standard Concertina: FM 5-34, Table 3-4, with rolls of concertina increased by 1 to match palletized loading

Four Strand Fence: FM 5-34, Table 3-4

Command Post: No bill of materials listed in engineer field manuals, used I Corps Class IV Kit #3

2-Man Position with Cover: FM 5-103, p. 3-21

Fighting Bunker: No bill of materials listed in engineer field manuals, used I Corps Class IV Kit #3

Perimeter Bunker/Tower: FM 5-103, p. C-16

Mortar Position with Overhead: FM 5-103, p. 4-12, with same overhead allowance as 2-man position plus sandbagging

Obstacle Materials: Approximates a generic engineer company 10-ton load set of materials for obstacle construction

Field Artillery Revetment: AFCS Facility 14910FA

Air Defense Revetment: AFCS Facility 14910PC

Heliport: AFCS Installation AF3131, minimum requirements

Latrine: AFCS Facility 72321AA, 125-man burnout latrine with wood frame, plywood floor

Unit Structures

Guidance was provided by the Office of the Deputy Chief of Staff, Operations (ODSCOPS) regarding the unit composition, strength, and major weapon systems for each type of division, separate brigade, and armored cavalry regiment. Tables giving each unit's B/F requirements are located in Appendix E. Data provided by ODSCOPS is in the "Unit Structure" section.

Unit B/F Emplacement Requirements

In the unit B/F requirements tables in Appendix E, the data in the section "Emplacements Required Per Unit Location" was developed with the assistance of the Army Engineer School and refined from feedback received through the study's corps points of contact.

The divisional unit requirements in total materials and in pounds per person per location (original and subsequent) are summarized in Table 3-7. This information supplies M_{TASK} with a unit of measure "pounds per person per location by division type." The corresponding N_{TASK} must provide the number and type of divisions and the number of their new locations over a period of days to complete the computation of an appropriate divisional Class IV planning factor for barriers and fortifications. This data was readily available in the FASTALS input, and EXCEL spreadsheets were constructed from each of the scenarios to determine the appropriate planning factors. These are summarized in Table 3-8.

Nondivisional Class IV Requirement for Barriers and Fortifications

The lack of a standard theater or corps organizational structure made the calculation of the nondivisional B/F requirements less straightforward than the divisional calculation. The number and type of support units in the corps and at echelons above corps are dependent on the requirements of each specific contingency. FASTALS data provided sufficient information to establish the organizational structures for the three scenarios in question. To complete the set of data for the calculation, a unit B/F requirements table was devised using the approach taken for the divisional units. In this case, however, the unit requirements were defined more generically by grouping units with similar requirements together.

Table 3-7 Summary Class IV Consumption Rates for Divisional Units

CLASS IV MATERIALS				POUNDS OF MATERIALS REQUIRED FOR ORIGINAL LOCATION								
DESCRIPTION	UNIT WEIGHT	UNIT OF ISSUE	PERCENT REUSABLE	ARMOR	MECHANIZED	INFANTRY (LT)	AIRBORNE	AIR ASSAULT	ARMORED CAVALRY REGIMENT	SEPARATE ARMOR BRIGADE	SEPARATE MECHANIZED BRIGADE	SEPARATE LIGHT INFANTRY BRIGADE
NAILS	1.00	LB	0.00	14016	14124	11256	12129	13665	2625	3558	3666	3285
LUMBER	2.68	BF	0.50	2815479	2833478	2524145	2880729	3317969	711717	692083	718379	811472
PLYWOOD 3/4IN 4X8FT SHEET	68.00	SH	0.50	838100	842384	808384	907732	1072292	201144	197948	204680	250376
BARBED WIRE	95.00	SL	0.00	275595	276735	248425	244245	290035	29165	68115	68210	62510
METAL FENCE POST (LONG)	10.00	EA	0.80	805020	809820	745820	734220	858800	107340	197400	199600	188400
METAL FENCE POST (SHORT)	4.90	EA	0.80	16415	16474	10927	10711	12299	2068	4675	4704	2999
BARBED TAPE CONCERTINA - 50FT	37.50	RO	0.80	867488	874238	784238	759488	868125	135413	222750	227250	211500
SAND GRID - 8 X 12 FT	105.00	EA	0.20	176400	176400	264600	352800	352800	44100	0	0	0
SAND BAGS	22.00	HD	0.70	334840	335126	296626	301686	334906	93720	85624	87010	90332
STEEL CULVERT	10.00	FT	0.10	32520	32520	32520	32520	108400	10840	0	0	0
MISCELLANEOUS	1.00	EA	0.00	433755	437446	339323	371926	703566	120222	79023	82711	67986
TOTAL POUNDS (ORIGINAL LOCATION)				6609628	6648745	6066263	6608186	7932857	1458353	1551176	1596210	1688860
POUNDS PER PERSON (ORIGINAL LOCATION)				374.82	371.92	522.77	488.63	486.38	308.25	348.97	335.55	432.93
TOTAL POUNDS (SUBSEQUENT LOCATION)				3158780	3177268	2903401	3225428	4030513	730559	706364	728530	772384
POUNDS PER PERSON (SUBSEQUENT LOCATION)				179.13	177.73	250.21	238.50	247.12	154.42	158.91	153.15	198.00

The B/F requirements for corps and EAC units were determined by sorting the units into seven broad categories: headquarters units, field artillery, aviation, air defense, combat and combat heavy engineer battalions, and two aggregate groups of units. The first aggregate group contained units of type: civil affairs (CA), Adjutant General (AG), military law (JA), finance (FI), public affairs (PA), psychological operations (PO), transportation (TC), medical (MD), military intelligence (MI), and military police (MP). The second aggregate group contained units of type: maintenance (MT), signal (SC), chemical (CM), ordnance (OD), quartermaster (QM), and the remaining engineer units (EN). The unit requirements were based on populations rounded to the nearest hundred. A table of unit B/F requirements for each of these categories is in Appendix F.

The FASTALS output data was used to determine the number, type, and strength of the nondivisional units as well as their movements over the course of time. Units were grouped first by their location in logical regions (division, corps, corps rear, COMMZ) and then into one of the seven categories described above. Populations were determined for each category in each region, and Class IV consumption rates were calculated for each according to the population shifts identified in the FASTALS population workloads. The results are summarized in Table 3-9.

Summary and Conclusions

This chapter described the methods used to calculate the Class IV supply requirement associated with base development and barrier/fortification emplacements for the three scenarios used in TAA-2001. Table 3-10 summarizes the total Class IV requirement by 10-day period for each.

These raw consumption totals indicate that the Class IV requirement varies erratically for both base development and B/F emplacement, though the largest variations occur with B/F emplacements. For the divisional level emplacements, caution must be taken since the underlying data used for the calculation was very low resolution. Population shifts for the divisions were quite drastic, with the data indicating that an entire division arrived and took its position within a 10-day time interval. In reality, the consumption would be smoother than this data indicates since a division's smaller component units would arrive and take new positions over a longer period of time. The nondivisional totals were derived using much higher resolution data, yet similar fluctuations in the consumption totals are seen. This is directly traceable to each scenario's movement patterns and to the study's rule of thumb that a unit requires new B/F emplacements at each new

location. During periods in which units stayed in the same location, Class IV consumption was limited to the requirements of newly arrived units.

Table 3-11 indicates the associated consumption rates in lb/person/day. The higher rates in the first 30 days result from two key factors: (1) B/F consumption is exceptionally high because, in each scenario, the initial response force withdrew to new positions during each of the first three periods, a situation leading to the highest possible consumption rate for B/F, and (2) base development work, though proceeding at a steady rate in absolute supply consumption, had a much higher lb/person/day rate in the first 30 days because of the smaller population during that time.

Table 3-8 Divisional Barrier/Fortification Data for TAA-2001 Scenarios

DIVISIONAL COMPOSITION	EUROPE	MRCW	MRCE
Armor Division	1		2
Mechanized Division	4	3	3
Infantry (LT) Division	1	2	
Airborne Division	1		1
Air Assault Division			1
Armored Cavalry Regiment	3	1	2
Separate Armored Brigade	2	1	
Separate Mechanized Brigade	1		2
Separate Light Infantry Brigade		2	

ADDITIONAL INFORMATION	EUROPE	MRCW	MRCE
Total Pounds of Class IV Consumed	109,706,884	100,303,223	137,013,122
Average Daily Divisional Population	196,435	50,192	83,416
Number of Days (C-Day to Cease Fire)	35	140	115
Average Number of Unit Relocations	2.55	4.88	4.28

CLASS IV CONSUMPTION RATES	EUROPE	MRCW	MRCE
Evenly Distributed Across Divisional Population	15.96	14.27	14.28
Average Across 10-Day Time Periods	16.71	13.40	14.64

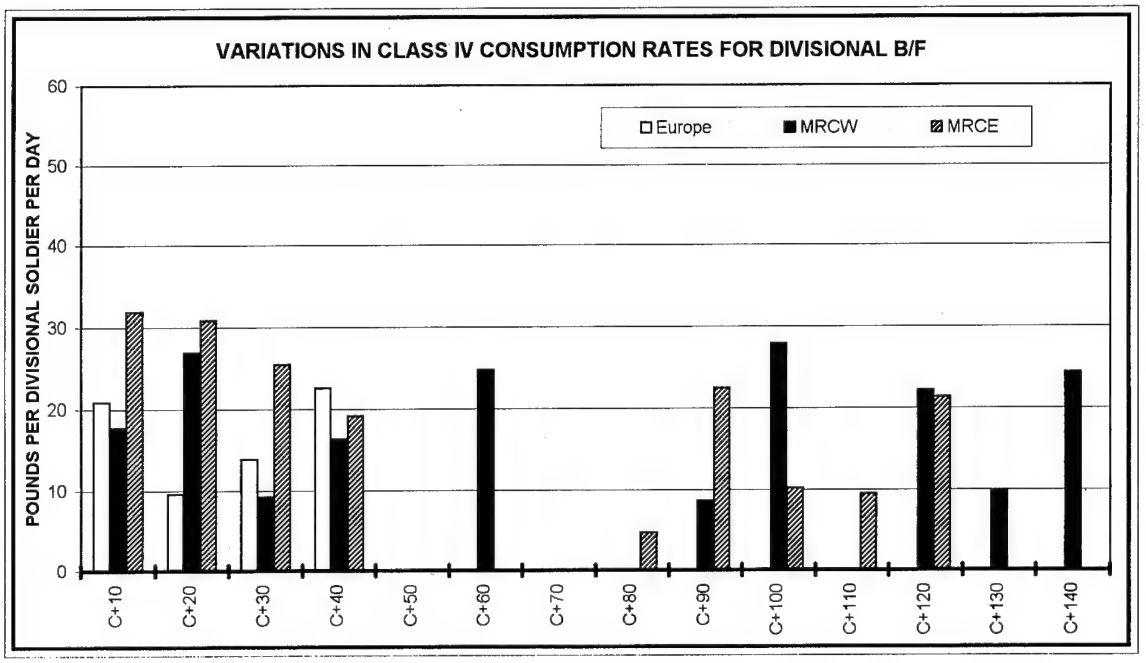


Table 3-9 Nondivisional Barrier/Fortification Data for TAA-2001 Scenarios

THEATER ARMY AND CORPS COMPOSITION	EUROPE	MRCW	MRCE
HHC, HHB (ALL TYPES)	8.41%	9.83%	8.95%
AV - AVN BN	8.28%	5.34%	4.64%
EN - EN BN (CBT LT ASLT, CBT MECH, CBT)	5.58%	10.68%	7.99%
FA - TGT ACQ BTRY	0.06%	0.06%	0.03%
FA - 155MM T BN	0.03%	2.39%	0.24%
FA - 155MM SP BN	3.47%	1.17%	1.01%
FA - MLRS BTRY	4.79%	2.96%	2.71%
AD - AD BN	2.59%	4.33%	3.05%
CA, AG, JA, PA, PO, TC, MD, MI, MP	36.90%	33.14%	42.83%
MT, SC, CM, OD, QM, REMAINING EN	29.87%	30.10%	28.55%

ADDITIONAL INFORMATION	EUROPE	MRCW	MRCE
Total Pounds of Class IV Consumed	210,372,733	127,320,179	189,876,694
Average Daily Nondivisional Population	378,811	124,264	221,142
Number of Days (C-Day to Cease Fire)	35	140	115
Average Number of Unit Relocations	2.16	4.00	4.50

CLASS IV CONSUMPTION RATES	EUROPE	MRCW	MRCE
Evenly Distributed Across Nondivisional Population	15.87	7.32	7.47
Average Across 10-Day Time Periods	15.63	8.38	9.48

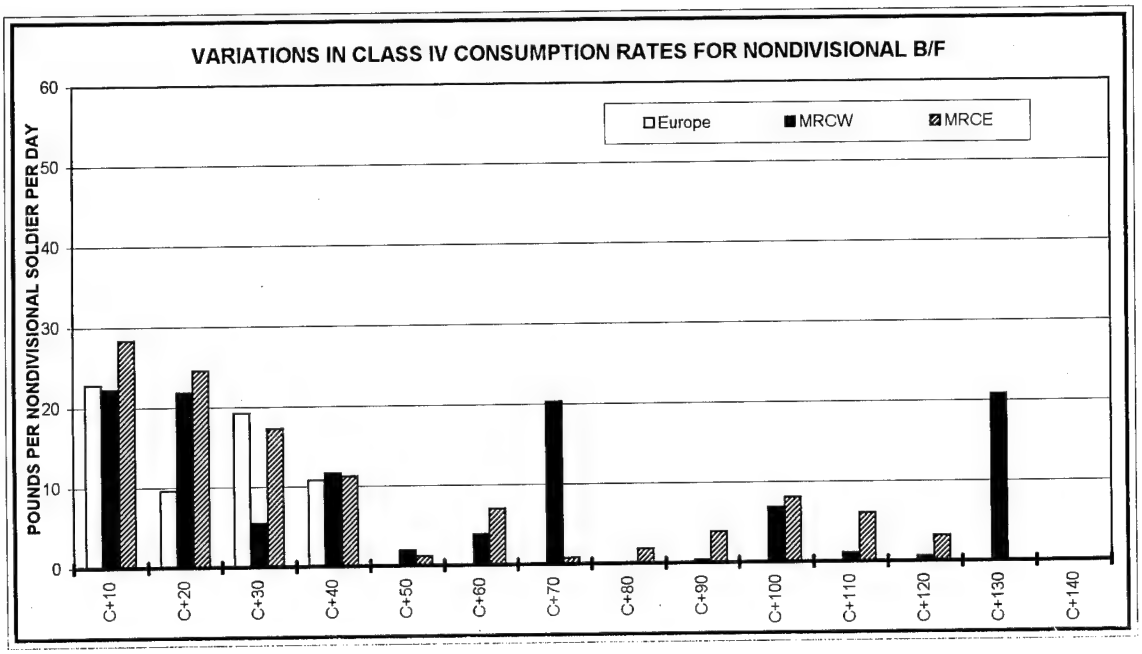


Table 3-10 Total Class IV Consumption by Time Period
TAA-2001 Scenarios

EUROPE	C+10	C+20	C+30	C+35
Class IV Consumption (LB)	141,176,945	81,160,222	123,687,032	51,177,387
Base Development - COMMZ	22,289,422	23,897,608	18,092,016	7,202,426
Base Development - Corps	1,671,155	2,255,038	1,404,899	309,406
Barrier/Fortification - Nondivisional	74,238,325	36,511,359	77,568,547	22,054,503
Barrier/Fortification - Divisional	42,978,044	18,496,218	26,621,571	21,611,052
Divisional Population	205,825	194,326	191,582	191,582
Nondivisional Population	325,539	380,162	402,801	406,741
Total Population	531,364	574,488	594,383	598,323

MRCW	C+10	C+20	C+30	C+40	C+50	C+60	C+70
Class IV Consumption (LB)	23,149,068	29,501,952	14,829,084	25,780,220	9,660,720	21,450,611	33,226,519
Base Development - COMMZ	6,676,565	8,956,516	8,299,225	7,487,895	7,362,828	7,404,371	7,583,887
Base Development - Corps	4,029	86,583	59,849	33,302	49,644	49,445	44,397
Barrier/Fortification - Nondivisional	14,053,366	15,551,757	4,430,147	12,813,966	2,248,248	4,870,774	25,598,235
Barrier/Fortification - Divisional	2,415,108	4,907,095	2,039,862	5,445,057	0	9,126,021	0
Divisional Population	13,589	18,264	22,166	33,245	33,245	36,924	36,702
Nondivisional Population	63,181	71,189	81,310	109,826	115,139	126,097	126,097
Total Population	76,770	89,453	103,476	143,071	148,384	163,021	162,799

(continued)	C+80	C+90	C+100	C+110	C+120	C+130	C+140
Class IV Consumption (LB)	10,316,087	14,225,824	42,442,229	13,041,824	32,013,898	56,459,771	33,668,634
Base Development - COMMZ	9,931,369	9,598,721	9,752,236	11,040,938	10,467,429	13,078,659	11,646,119
Base Development - Corps	165,677	172,882	356,277	278,249	558,949	804,481	192,516
Barrier/Fortification - Nondivisional	219,040	488,791	10,421,561	1,722,637	1,057,024	33,844,631	0
Barrier/Fortification - Divisional	0	3,965,431	21,912,155	0	19,930,497	8,731,999	21,829,998
Divisional Population	36,527	45,889	78,509	78,020	90,064	89,775	89,775
Nondivisional Population	126,625	127,760	152,265	156,345	158,865	162,500	162,500
Total Population	163,152	173,649	230,774	234,365	248,929	252,275	252,275

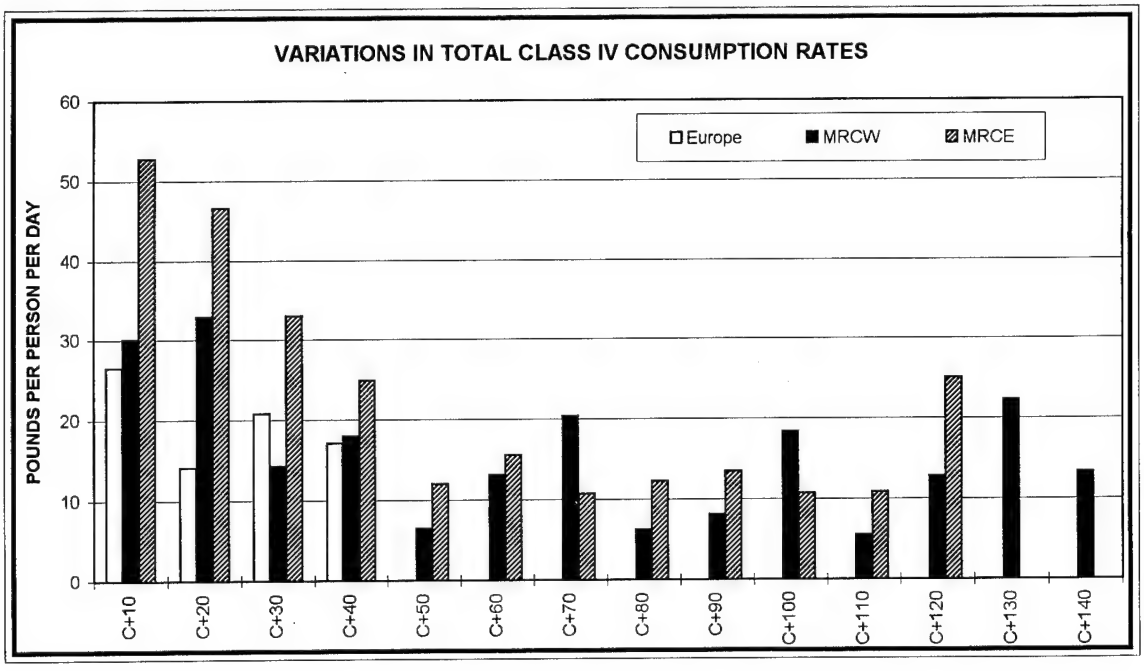
MRCE	C+10	C+20	C+30	C+40	C+50	C+60	C+70
Class IV Consumption (LB)	45,455,352	83,900,813	83,133,816	65,197,569	31,932,029	47,145,245	32,906,832
Base Development - COMMZ	20,107,328	36,191,146	33,011,976	29,637,601	29,272,205	30,539,344	30,587,150
Base Development - Corps	91,231	139,260	776,882	455,307	233,892	249,964	443,790
Barrier/Fortification - Nondivisional	17,999,876	31,226,074	31,383,743	21,686,214	2,425,932	16,355,937	1,875,893
Barrier/Fortification - Divisional	7234237	16344333	17961215	13418447	0	0	0
Divisional Population	22,681	53,035	70,558	69,764	68,504	68,560	68,009
Nondivisional Population	63,378	127,028	180,996	191,794	197,547	234,308	238,889
Total Population	86,059	180,063	251,554	261,558	266,051	302,868	306,898

(continued)	C+80	C+90	C+100	C+110	C+120
Class IV Consumption (LB)	40,083,922	51,664,784	45,469,010	46,956,899	54,580,350
Base Development - COMMZ	31,448,252	16,689,560	8,492,005	16,430,842	16,383,488
Base Development - Corps	233,619	99,282	0	0	0
Barrier/Fortification - Nondivisional	4,730,123	10,684,081	23,665,677	18,124,169	9,718,975
Barrier/Fortification - Divisional	3,671,928	24,191,861	13,311,328	12,401,887	28,477,886
Divisional Population	77,474	107,406	130,265	131,291	133,447
Nondivisional Population	250,003	275,030	294,413	298,526	301,787
Total Population	327,477	382,436	424,678	429,817	435,234

Table 3-11 Summary Data
Total Class IV Consumption for TAA-2001 Scenarios

CONSUMPTION RATES	UNITS	EUROPE	MRCW	MRCE
Average by 10-day Period - Class IV Materials	lb/person/day	19.65	15.90	22.35
Base Development	lb/person/day	3.71	5.86	10.61
Barrier/Fortification	lb/person/day	15.94	10.04	11.73
Even Distribution - All Materials	lb/person/day	26.31	16.46	18.27
Even Distribution - Class IV Materials	lb/person/day	19.75	14.73	17.20
Even Distribution - Local Materials	cy/person/day	1.65	1.04	1.45

ADDITIONAL DATA	UNITS	EUROPE	MRCW	MRCE
Average Daily Population	person	574,640	174,457	317,799
Total Number of Days (C-Day to End)	day	35	140	115
Total Materials Consumed	pounds	529,116,555	401,912,573	667,815,146
Total Class IV Materials Consumed	pounds	397,201,587	359,766,440	628,426,621
Total Local Cube Consumed	cubic yards	33,145,636	25,385,820	52,859,820



CHAPTER 4: RECENT EXPERIENCES

Introduction

The preceding chapter described the use of simulation data to forecast the Class IV supply requirement for three contingencies that have been the subjects of extensive planning and analysis. The questions to be answered in the TAA process focus on determining minimum requirements, primarily of force structure, for the types of contingencies the Army must be prepared to face. This perspective and the structure of the data used for the initial calculations do not fully capture what would be the total likely requirement for Class IV supplies in actual combat operations. The ESSC workload factors, for example, are based on extremely austere construction practices. The findings of the preceding chapter, then, must be viewed as establishing only a possible lower bound on the Class IV requirement. Additionally, the requirement may be met in a number of ways, including procurement through military channels, procurement through host/coalition nation or commercial contracting, and even accepting the risks and inconveniences associated with not completing the requirement. To explore these areas—to determine what might actually be done versus what has been scripted for analysis—the study turned to historical records.

A key assumption of this study is that many of the factors affecting the current use of Class IV supplies have changed during the past 20 years. These include:

- the shift of operations from global warfare to regional conflicts,
- the lack of an adversary capable of matching America's high-tech arsenal,
- the worldwide proliferation of sophisticated weapons,
- new rhythms in the pace and flow of battle,
- the change from a conscripted armed force to one of highly-trained, professional soldiers, and
- the heightened emphasis on minimizing friendly casualties.

Some of these changes have an obvious impact on the Class IV requirement. When the nation faced a known threat, the adjacent region's infrastructure was developed in advance and generally was ready to support operations. Now, with "hot spots" all over the world, many in underdeveloped countries, advance preparation cannot be so complete; future base development plans may have to be

more extensive. Air superiority and sophisticated air defense systems may decrease the need for hardening positions, while, on the other hand, the open-market availability of long-range weapons may mean that even the least formidable enemy is capable of inflicting unacceptable losses to our rear area positions. Modern warfare, especially ground warfare, is characterized by long intervals devoted to building for strikes and short intervals in which to actually conduct them, a less even pace than has been seen in the past. This will perhaps allow more time during the prestrike period to harden positions and will require more construction of storage and maintenance facilities to accommodate the buildup, each of which increases the demand for Class IV materials. Additionally, the modern soldier, a technologically skilled and individually more potent fighting force than ever before, requires more facility support than ever before. The necessity of improved living conditions and increased survivability point inevitably to a larger consumption of Class IV materials.

Given the assumption that these recent changes in the conduct of war have unique influences on the Class IV requirement, this study limited its exploration of historical records to the most recent 20-year period, which included only one major contingency: Operation Desert Shield/Storm. This chapter contains a description of the data gathered about the Class IV requirements during ODS. In processing this data, study personnel noticed a potential for the Class IV planning factor to become "self-predicting," i.e., rather than forecasting the Class IV requirement, the planning factor itself might determine the amount of materials available for consumption. This chapter presents evidence supporting this observation. Time limitations precluded a thorough investigation of the Class IV requirements of minor contingencies, though some information was gathered about base development during Operation Continue Hope in Somalia. That data is presented here, not with the intention of implying that the planning factor methodology can be successfully applied to lesser contingencies but to provide as much available information as possible. While this portion of the study is admittedly somewhat narrow in scope, the information gathered did serve to improve the reliability of the study's findings.

Operation Desert Shield/Storm

Iraq invaded Kuwait on August 2, 1990. Operation Desert Shield began 5 days later, August 7 (C-Day). Lead elements of the 82nd Airborne Division began arriving by August 9, and were followed rapidly by elements of the 24th Infantry Division (Mechanized), the 101st Airborne Division (Air Assault), and the 1st Cavalry Division—all closed in theater by the end of October. By the beginning of Operation Desert Storm on January 17 (D-Day), the XVIII Airborne Corps was

in country. And VII Corps arrived by February 6, in time for the beginning of the ground phase of the campaign on February 24 (G-Day). Cease fire was initiated on February 28, with cease-fire terms accepted by Iraq on March 3. In a span of only 209 days, 245,000 Army soldiers had taken their positions and accomplished their mission.

To determine the Class IV requirement generated by the Gulf War, USACERL researchers accessed several electronic databases available through the U.S. Army Logistics Support Activity (LOGSA). The primary sources of data were extracts from the Logistics Intelligence File (LIF) and the AMDF. The LIF is the Army's centralized database for supply and transportation information. It uses an automated system to extract item-level requisition data from worldwide customers to provide a means for tracking Army-sponsored and managed requisitions through the wholesale supply and transportation systems. The AMDF is the Army's catalog of standard stock items. A portion of the AMDF database, called the ARMYLOG, is available on CD-ROM. The study used both the AMDF extract furnished by LOGSA and the ARMYLOG. The tabulation of the total ODS Class IV requisition history was accomplished by converting flat files produced on a mainframe to dBase® files processed on a personal computer.

LOGSA provided a comprehensive database of items with supply class "4" that were requisitioned worldwide in the time before, during, and after the ODS timeframe. This database contained 175,747 records, each 85 bytes long. The records contained the NSN of each item ordered, the quantity ordered, the required delivery date, data regarding the ordering agency and shipping dates, a geographic area code for destination, and a project code. From the original database, records were extracted to correspond to the time between 7 August and 3 March, with either a geographic area code of Saudi Arabia or Kuwait or a project code used for ODS (9AU, 9BU). This resulted in an ODS Class IV database of 12,815 records.

The AMDF file extract contained a comprehensive set of NSN items with supply class "4" —7,231 records. Data fields included the unit of issue, unit weight, unit cube, and unit price. A major difficulty arose with this database in that the field of most interest—the unit weight of the item—was blank in most cases. This was due to several factors: Class IV items are easily obtained on the commercial market and do not require the type of detailed tracking needed by specific items such as equipment repair parts, Class IV items change frequently and have multiple sources so the effort to maintain the records often outweighs the benefit, and the AMDF itself is still a developing electronic database that is not fully populated. To make the Class IV AMDF database useful, USACERL researchers

used the master file maintained as a part of the AFCS database to complete the unit weight data as much as possible. The remaining blank fields were completed by assigning generic weights according to the units of issue (examples: pint = 1.25 lb, quart = 2.5 lb, gallon = 10 lb, boardfoot = 2.5 lb for softwood or 2.68 lb for hardwood, drum = 455 lb, etc.). Each record was then examined for reasonableness. Weights of some of the high-demand items were actually verified more thoroughly by consulting multiple sources.

With the ODS Class IV database and the AMDF Class IV database converted to easily managed dBase® files, processing began to determine what had been ordered and how much weight was involved. Table 4-1 contains a list of the top 50 items (by weight). These 50 items account for over 97 percent of the total weight of the items requisitioned. The study was unable to determine how much of the ordered material actually arrived at its destination—again, the database had not been completely populated for Class IV items. For this study, however, the initiation of the requisition was sufficient to register the requirement for the material, a more important quantity to derive than the actual consumption.

Examination of the list of items in Table 4-1 indicates that almost all of the materials are barrier/fortification materials. Some of the lumber, plywood, and nails could have been used for troop camps and prisoner of war facilities, though these types of facilities were not constructed in quantities that would account for a significant portion of the items ordered. Published accounts of Combat Heavy Engineer activity during ODS indicate that a substantial number of construction projects for new roads, pipelines, storage facilities, and heliports were completed, yet the LIF file contained few records for the materials required for such tasks. As a follow-up to this observation, study personnel talked with Corps of Engineer staff members at Transatlantic Division, which had served as the Middle East/Africa Projects Office (MEAPO) during the Gulf War. They indicated that much of the construction during ODS was completed with supplies furnished by Saudi Arabia or coalition nations, especially Japan. Some construction materials were purchased locally, and, in one case, the Army actually contracted to have engineer troops operate a local asphalt plant. The LIF's automated data collection system did not record such transactions, at least not as a "Class IV" requisition.

Another observation to be made from examining the entire list of requisitioned Class IV items is that the variety of items is actually quite small. A summary list is given in Table 4-2.

Table 4-1 Top 50 Class IV Items Ordered During ODS
(2 AUGUST 1990 TO 3 MARCH 1991)

RANK	NSN	DESCRIPTION	QUANTITY	UI	UI WEIGHT (LB)	TOTAL WEIGHT (LB)
1	5660009215516	BARBED TAPE CONCERTINA 37.5-50FTLG	1606401	RO	37.50	60240037.50
2	8105001429345	BAG SAND MIL52472T1-2	901591	HD	22.00	19835002.00
3	5660002701587	POST FENCE STEEL 5 FT O/ALL LENGTH	1803899	EA	10.00	18038990.00
4	5530006188073	PLYWOOD 3/4IN EXT 4X8FT SHEET	247151	SH	68.00	16806268.00
5	5660002701510	POST FENCE STEEL 6 FT DRIVE TYPE	1384562	EA	10.08	13956384.96
6	5510002206226	LUMBER SOFTWOOD DIM 2 COM 4X4XRL	4409343	BF	2.68	11817039.24
7	5680011987955	GRID, SAND CONFINEMENT, 8 X 12 FT	106600	EA	105.00	11193000.00
8	5510002206194	LUMBER,SOFTWOOD DIM 2X4XRL	3818526	BF	2.50	9546315.00
9	5660002514482	BARBED WIRE	71098	SL	95.00	6754310.00
10	8105002854744	BAG SAND BURLAP	145412	HD	39.00	5671068.00
11	5510002206196	LUMBER SOFTWOOD DIM 2 COM 2X6XRL	1526972	BF	2.68	4092284.96
12	5660002629914	POST FENCE METAL' 8 FT LG	291152	EA	12.00	3493824.00
13	8105013314019	BAG,SAND	112157	HD	30.00	3364710.00
14	5660002248663	BARBED WIRE 2 STRAND 100LB SPOOLS	20464	SL	105.56	2160179.84
15	5660002701589	POST,FENCE,METAL	385446	EA	4.90	1888685.40
16	8105009357101	BAG SAND ACRYLIC 26 IN LGX14 IN WI	60427	HD	27.00	1631529.00
17	8010012763640	POLYURETHANE COATIN	31716	CN	50.00	1585800.00
18	5530001297833	PLYWOOD AC EXT 5-PLY 3/4X48X96 IN	20950	SH	72.10	1510495.00
19	5510002206198	LUMBER SOFTWOOD DIM 2 COM 2X8XRL	513330	BF	2.68	1375724.40
20	5510002206200	LUMBER SOFTWOOD DIM 2 COM 2X10XRL	437828	BF	2.68	1173379.04
21	5530006186958	PLYWOOD,CONSTRUCTIO	33241	SH	35.00	1163435.00
22	5530001285143	PLYWOOD CC EXT 5-PLY 1/2X48X96 IN	21701	SH	48.00	1041648.00
23	5315000104659	NAIL COMMON WIRE STEEL 8D	20809	BX	50.00	1040450.00
24	5680009218731	T17 MEMBRANE SET TAXIWAY 3000 SQ FT	405	SE	2475.00	1002375.00
25	5660007204527	FENCING,WIRE	3453	RO	270.00	932310.00
26	5510002206202	LUMBER SOFTWOOD DIM 2 COM 2X12XRL	343698	BF	2.68	921110.64
27	5660002701588	POST,FENCE,METAL	212152	EA	4.03	854972.56
28	5610002330018	ASPHALT,PETROLEUM	1580	DR	455.00	718900.00
29	5530001285129	PLYWOOD,INT.,3/4X48X96"	10000	SH	68.00	680000.00
30	5510002206086	LUMBER,SOFTWOOD,BOA	259973	BF	2.50	649932.50
31	5510002206080	LUMBER SOFTWOOD BD 2 COM 1X6XRL	226313	BF	2.68	606518.84
32	5510002206154	LUMBER,SOFTWOOD,DIM	241646	BF	2.50	604115.00
33	5510005519747	LUMBER SOFTWOOD TIMBR 1 COM 6X12X1	221439	BF	2.68	593456.52
34	5610002504676	CEMENT PORT GEN CONC CONSTR 94LB	6012	BG	94.00	565128.00
35	5530001285531	PLYWOOD,SOFTWOOD,CO	11247	SH	50.00	562350.00
36	5530001297777	PLYWOOD AC EXT 5-PLY 1/2X48X96 IN	10709	SH	48.00	514032.00
37	5510002206110	LUMBER,SOFTWOOD,BOA	199109	BF	2.50	497772.50
38	5530002628182	PLYWOOD AB EXT 5PLY 3/4X48X96 IN	6694	SH	71.00	475274.00
39	5530002628195	PLYWOOD EXTERIOR 1/2X48X96IN	9735	SH	48.00	467280.00
40	5530006186956	PLYWOOD,SOFTWOOD,CO	12576	SH	36.00	452736.00
41	5510002206084	LUMBER SOFTWOOD BD 2 COM 1X10XRL	127795	BF	2.68	342490.60
42	5510002206222	LUMBER,SOFTWOOD,DIM	130234	BF	2.50	325585.00
43	5510001676855	LUMBER,SOFTWOOD,DIM	124428	BF	2.50	311070.00
44	5510006634687	LUMBER SOFTWOOD DIM TRTD;2X4X12	102880	BF	2.68	275718.40
45	5510001343977	LUMBER,SOFTWOOD,DIM	100000	BF	2.50	250000.00
46	5510001344008	LUMBER	100000	BF	2.50	250000.00
47	5510002206228	LUMBER SOFTWOOD DIM 2 COM 4X6XRL	89055	BF	2.68	238667.40
48	8010012600908	POLYURETHANE COATIN	11054	KT	20.00	221080.00
49	5510005519868	LUMBER SOFTWOOD DIM TRTD 1;2X12XRL	80000	BF	2.68	214400.00
50	5510002206148	LUMBER,SOFTWOOD,DIM	81492	BF	2.50	203730.00

Table 4-2 Summary of Materials and Quantities Ordered During Operation Desert Shield/Storm

ITEM	POUNDS	QUANTITY	
Barbed Wire	70,195,944	1,703,433	ROLLS
Pickets	38,298,833	4,205,910	EACH
Lumber	36,944,185	14,177,475	BOARDFEET
Sand Bags	30,502,309	1,219,597	HUNDREDS
Plywood	24,596,798	406,899	SHEETS
Sand Grid	11,193,000	106,600	EACH
Paint, Sealers, Adhesives	2,613,607		
Nails	1,361,592		
Landing Mat	1,002,375	405	SETS
Asphalt	723,400	1,590	DRUMS
Cement	565,128	6,012	BAGS
Miscellaneous	299,136		
TOTAL WEIGHT	**218,296,307**		

The Potential for a "Self-Predicting" Planning Factor

As described in the preceding section, the item-level Class IV requisitions for ODS were used to capture the summary information in Table 4-2. This data was gathered during a relatively early period of the current study, before all of the numbers discussed in Chapter 3 had been calculated. As a matter of curiosity, study personnel made a simplifying assumption that the Army population had grown linearly from 0 to 245,000 over the course of the 209 days from C-Day to final cease fire and determined an evenly distributed Class IV consumption rate as follows:

$$218{,}296{,}307 \text{ lb}/(122{,}500 \text{ person} * 209 \text{ days}) = 8.53 \text{ lb/person/day}$$

This was a remarkable number for such a calculation—an answer in almost exact agreement with the Class IV planning factor that has been used for over 25 years. The coincidence was remarkable enough to inspire further investigation.

The study had produced enough information from the TAA data to indicate that the Class IV consumption rate varies quite a bit, both on average across different contingencies and within each single contingency across different phases of the conflict. The base development portion of the requirement is generally substantial, yet the ODS data did not even include the materials used for such tasks. Also, firsthand anecdotes from soldiers deployed to ODS had indicated that the Class IV requirements greatly exceeded onhand inventories, especially in the first

2 months. At the heart of these inconsistencies, USACERL researchers discovered that the way in which engineer planners determine a contingency's Class IV requirements produces a significantly different number than the number used by logistics planners to determine the resources to move and store the required materials.

As noted in Chapter 3, the FASTALS model does not determine the Class IV supply requirement related to the amount of engineer labor commitments generated by the construction model. The transportation and logistics models use the Class IV planning factor to estimate the requirements for storage and hauling. In other words, the calculations of what is required to move and store Class IV materials are made on the basis of the planning factor and not on the basis of a generated supply requirement, which, from the study's findings, can vary substantially. The results of the TAA process ultimately affect the Army's actual force structure, helping to determine the correct mix of, for example, truck companies and material handlers. In an actual combat operation, the true Class IV requirement could potentially be overshadowed by the logistical limitations on how much material can be moved to where it is needed.

The lack of an interface between the engineer and logistics sections in FASTALS is not an isolated example. In the experience of USACERL researchers with engineer representations in the Army's analytic combat models, logistics considerations have not been a priority. The engineer community has focused almost exclusively on modeling the manhour and equipment requirements, leaving the supply requirements to the logisticians. The lack of an interface also exists between engineers and logisticians during OPLAN preparation. LTC Mark W. Potter, in a 1986 report for the U.S. Army War College described the procedures for developing the Civil Engineer Support Plan (CESP) using the automated system called the CESP Generator (CESPG) and included the following discussion:

> There is a discrepancy in the planning process between the material requirements generated by the CESPG and the cargo planning factors used by the logistic planners in their portion of OPLAN development. The intent of the CESPG Non-unit Cargo Program is to provide a Class IV requirement, in terms of short and measurement tons, that is fed into the TPFDD [Time-Phased Force and Deployment Data] to be used by logistic planners. The information also affects material timing and flow since it is identified by base complex, POD [port of debarkation], POE [port of embarkation], and scheduled arrival date. In practice, since the logistic planners are doing their planning concurrently with CESP development, CESPG input for construction material is not available to them for planning. The logistic planners have a separate

software program and planning factors which do not agree with the planning factors used by CESPG. There is no direct interface between CESPG and the Movement Requirements Generator (MRG) or the Transportation Feasibility Estimator (TFE). The result is a set of gross Class IV material requirements in the TPFDD that may not agree with actual Class IV requirements to satisfy CESP needs.

In actual theater operations, the effort to meet the Class IV requirement may suffer in two ways: the true Class IV requirement has not been used to plan transportation and handling requirements, and hauling/handling capacities are typically well below computed requirement levels.

The Class IV planning factor plays a key role in the problem. The disparities between engineer requirements for Class IV and logistics capabilities to deliver it are greatest when the planning factor is too rigid, especially as it has been when a single number was used. The planning factor methodology resulting from this study is intended to capture the significant variations in Class IV requirements and the circumstances that produce them in a way that will allow logisticians to compute a more accurate Class IV requirement for each specific contingency. In instances where automated systems carry the burden of computation, however, the more logical approach would be to abandon the use of planning factors, construct an interface, and allow the automated system to compute the requirement using its larger and more complex data set. For example, the data for material requirements associated with the 23 tasks in FASTALS could be added to the model input and used in the construction model to compute the Class IV requirement, which would be sent to the transportation model in the place of the planning factor. This is a more flexible, more accurate, and less labor-intensive approach than using offline calculations with the current study's proposed methodology.

Class IV Supply Requirements During Lesser Regional Contingencies

During lesser regional contingencies when a force smaller than a division is deployed and relatively little or no combat is expected, the priorities of tasks that consume Class IV supplies shift dramatically. Base development during a major regional contingency focuses on lines of communication, on the storage and movement of the materiel required for combat, and on facilities for the casualties and prisoners that result from that combat. In a lesser contingency, the focus turns to troop support, primarily to construction of a secure and adequate base camp. In addition, engineer support of humanitarian efforts and disaster relief

spans a much larger range of tasks than those required in a major regional contingency. For these reasons, the study does not include lesser contingencies.

In the course of this study, however, engineers with the 10th Mountain Division, the 43d Engineer Battalion, and Third Army Headquarters were interviewed by telephone about their experiences during Operation Continue Hope (Somalia) in 1993. The purpose of these contacts was to explore current engineer operational practices and planning procedures as they relate to the consumption of Class IV supplies. The information gathered during these contacts included the bill of materials for a 1700-soldier base camp (Victory Base). A summary of the Class IV materials required for this base camp is included here in an effort to make as much information available as possible (Table 4-3).

Table 4-3 Summary of Class IV Materials Used to Construct Victory Base in Somalia (1993) 1700-Soldier Base Camp

ITEM	POUNDS	QUANTITY
Barbed Wire	79,410	2,042 ROLLS
Pickets	102,994	9,924 EACH
Lumber	1,120,386	442,003 BOARDFEET
Sand Bags	108,000	4,000 HUNDREDS
Plywood	179,808	3,366 SHEETS
Nails	6,982	6,982 POUNDS
Cement	9,400	100 BAGS
TOTAL WEIGHT	**1,606,980**	

CHAPTER 5: THE COMPUTATION OF CONTINGENCY-SPECIFIC CLASS IV PLANNING FACTORS

Introduction

The preceding two chapters have presented the work and findings of the first phase of the study, in which the requirements of specific contingencies were used to calculate a corresponding consumption rate for Class IV supplies. The results of this initial work indicate that the Class IV consumption rate varies not only from contingency to contingency but also across the different phases of a single contingency. The workload data used in these computations and the input received from subject matter experts showed that the Class IV requirement is most dependent upon:

- the type of forces deployed (heavy or light),
- the threat's capabilities,
- the force deployment rate,
- the force movement rate, and
- the percent of the LOC/facility requirement met by the existing infrastructure or through the use of host nation or contractor resources.

During the second phase of the study, a spreadsheet simulation model was constructed to explore the interactions of these factors and their effect on the associated Class IV requirement. This chapter explains how researchers constructed and modified the model, C4. It describes how researchers used C4 to calculate Class IV consumption rates for a variety of contingency conditions and how this large sample of consumption rates was analyzed. The chapter concludes with a description of a simple algorithm resulting from this analysis for computing contingency-specific Class IV planning factors.

Initial Observations

Planning factors based on "pounds per person per day" should be independent of the size of the force and its rate of growth. This is the case for supplies that are closely related to individual consumption, such as food. But Class IV supplies,

especially for base development, are not so closely related to individual consumption or, for that matter, daily consumption. The Class IV rate may exhibit considerable fluctuation, not because of large changes in the required quantity of Class IV supplies, but because of changes in the population base used to calculate the rate. In fact, the Class IV consumption rate tends to fall as the population increases because those portions of the requirement that are not tied to the population are then distributed over a larger base. The Class IV rate may also exhibit considerable fluctuation because the requirement is not constant and the consumption is not uniformly distributed over time. A division's Class IV requirement, for example, may be quite low after it has established its position but then rise sharply within a few days if it moves to a new location.

Class IV barrier/fortification requirements are sensitive to all of the key factors listed on the previous page. The divisional B/F requirements vary by division type, as can be seen in Table 3-6, and a division's movement rate determines how often supplies for new positions are required. In the computations in Chapter 3, the assumption was made that threat capability in all three cases implied a requirement for overhead cover. While not the most materially demanding fortification emplacement, the two-man fighting position with overhead cover accounts for a large portion of a division's Class IV supply requirement because of the sheer number of emplacements, especially for dismounted troops. Removing the requirement for overhead cover significantly reduces a division's Class IV requirements (Table 5-1). When the threat has no long-distance strike capability, the commander may choose to reduce the flow of Class IV fortification supplies because of the reduced risk. Latrines also require large expenditures of Class IV supplies. If the nondivisional forces are located in a region with a well-developed infrastructure, the requirement for field latrines decreases.

Base development tasks for LOCs and facilities fall into three categories: (1) new construction, (2) damage repair, and (3) maintenance. LOC construction was not represented in FASTALS, yet current operational planning for a number of possible contingencies indicates a need for new roads, pipelines, airfield facilities, and heliports. Contingencies in under-developed regions have a large requirement for base development tasks of all kinds, but the LOC construction requirement is more likely to fall in the mission critical category when the theater infrastructure is austere. Countering this requirement is an increasing reliance on host nation and contractor support, though whether that support is capable, timely, or affordable is subject to debate. In any case, the Class IV requirement is very sensitive to both the existing theater infrastructure assets and the available construction support. In the area of damage repair, some possibility exists for counterintuitive results. While the Class IV base development requirement would seem to be highest in an austere theater, a well-developed theater's requirements

Table 5-1 Summary Class IV Consumption Rates for Divisional Units

No Allowance for Overhead Cover for Fighting Positions

CLASS IV MATERIALS				POUNDS OF MATERIALS REQUIRED FOR ORIGINAL LOCATION								
DESCRIPTION	UNIT WEIGHT	UNIT OF ISSUE	PERCENT REUSABLE	ARMOR	MECHANIZED	INFANTRY (LT)	AIRBORNE	AIR ASSAULT	ARMORED CAVALRY REGIMENT	SEPARATE ARMOR BRIGADE	SEPARATE MECHANIZED BRIGADE	SEPARATE LIGHT INFANTRY BRIGADE
NAILS	1.00	LB	0.00	14016	14124	11256	12129	13665	2625	3558	3666	3285
LUMBER	2.68	BF	0.50	1992896	2008360	1610061	1736857	1994783	381209	501476	516940	469900
PLYWOOD 3/4IN 4X8FT SHEET	68.00	SH	0.50	595408	598944	538696	570248	681904	103632	141712	145248	149600
BARBED WIRE	95.00	SL	0.00	275595	276735	248425	244245	290035	29165	68115	68210	62510
METAL FENCE POST (LONG)	10.00	EA	0.80	805020	809820	745820	734220	858800	107340	197400	199600	188400
METAL FENCE POST (SHORT)	4.90	EA	0.80	16415	16474	10927	10711	12299	2068	4675	4704	2999
BARBED TAPE CONCERTINA - 50FT	37.50	RO	0.80	867488	874238	784238	759488	868125	135413	222750	227250	211500
SAND GRID - 8 X 12 FT	105.00	EA	0.20	176400	176400	264600	352800	352800	44100	0	0	0
SAND BAGS	22.00	HD	0.70	334840	335126	296626	301686	334906	93720	85624	87010	90332
STEEL CULVERT	10.00	FT	0.10	32520	32520	32520	32520	108400	10840	0	0	0
MISCELLANEOUS	1.00	EA	0.00	433755	437446	339323	371926	703566	120222	79023	82711	67986
TOTAL POUNDS (ORIGINAL LOCATION)				5544353	5580186	4882491	5126830	6219283	1030333	1304333	1335339	1246512
POUNDS PER PERSON (ORIGINAL LOCATION)				314.41	312.14	420.76	379.09	381.32	217.78	293.44	280.71	319.54
TOTAL POUNDS (SUBSEQUENT LOCATION)				2626143	2642989	2311515	2484750	3173726	516548	582942	598095	551211
POUNDS PER PERSON (SUBSEQUENT LOCATION)				148.92	147.84	199.20	183.73	194.59	109.18	131.15	125.73	141.30

may outpace it if the enemy is capable of inflicting a large amount of damage. This happens because a well-developed theater has many lucrative targets which, by their very existence, become critical to mission success while an austere theater has very little infrastructure to be damaged.

These observations highlight the complexity of the interactions between the different factors and their occasional counterintuitive effects on the Class IV requirement. To move beyond the four specific scenarios studied in the first phase, USACERL needed a way to study the Class IV requirements of a wider range of contingencies. The study required a system sensitive to the interactions between the factors that affect the Class IV requirement and capable of calculating credible Class IV consumption rates to match specific combinations of factors. The Class IV spreadsheet model USACERL developed to provide this capability is described below.

The Class IV Model, C4

Millions of pieces of data were processed during the first phase of the study, but it was all very static data, applicable to only a few specific situations. For each of the scenarios examined to this point, the Class IV requirements and all of the key factors affecting them had been determined long before the data was acquired. Researchers needed a way to generate new data sets representing different scenarios and calculate the consequent Class IV requirements. Computer simulation modeling was chosen as the best means to this end. A properly-constructed computer model would be capable of generating a large sample of different combinations of contingency conditions and their associated consumption rates. Analysis of this large sample ultimately would lead to the study's proposed algorithm for Class IV planning factors. The computer model, in itself, would provide a method for computing appropriate planning factors, but the study's goal was to derive an easy-to-use, publishable method. An elaborate computer model could not be the study's final product, but the number and complexity of the calculations required to determine a single contingency's Class IV consumption rate pointed to the need for such a tool as an intermediate step.

USACERL researchers felt that the computational method used in the first phase for the TAA-2001 scenarios was sound. Experience with replicating the FASTALS workload calculations had also established a familiarity with modeling Class IV requirements in a spreadsheet simulation format. Microsoft EXCEL® 5.0 was used to construct the model. This new version of EXCEL provides a workbook capability, allowing multiple spreadsheets to be linked together in a single work environment. The C4 model used three primary spreadsheets and three summary

spreadsheets. The three primary spreadsheets were the User Interface sheet, the Workload sheet, and the Simplifying Assumptions (SA) sheet.

The User Interface Sheet

This spreadsheet was designed to accept input regarding scenario conditions and to output summary results regarding the associated Class IV requirement. Table 5-2 illustrates the layout of this spreadsheet. The upper left quadrant of the sheet contains the required input. The right half of the sheet displays the output, including a block added later to compare the one-page estimate with the C4 calculation. The lower left quadrant displays a graph of the consumption rate over time. Changes to the input produce immediate changes in the output. The output itself is a summary of the results of many very complex calculations from the Workload sheet.

The Workload Sheet

The detailed calculations necessary to determine the Class IV requirement under different input scenarios are performed by the Workload sheet of C4. The first sections of this sheet contain calculations of a general nature: the divisional and nondivisional population for each of the eighteen 10-day time periods that the simulation is capable of representing; divisional and nondivisional barrier/ fortification requirements in "pounds per man per location" for original and subsequent positions under different situations (with overhead cover, without overhead cover, and with no field latrines outside of the division); the number of miles of road, pipeline, and railroad between the port area and the forward division supply points; the percent of the LOC/facility requirement met by the existing infrastructure (well-developed = 90 percent, developing = 50 percent, austere = 0 percent); the maximum percent damage to existing LOCs and facilities under three levels of enemy long-distance strike capability (no capability = 0 percent, moderate capability = 1 percent, and high capability = 10 percent).

The Workload sheet also contains a row of cells to indicate unit movement, with the cell entry for each time period indicating what percent of a unit's barrier/ fortification requirement is to be used during that time period for a new position. Newly arriving populations always require original positions, but populations already in place require only the level of materials indicated in the "unit movement" row. These entries range from 0 for no movement to 1 for a new position requiring maximum supply usage. Entries between 0 and 1 may indicate that a fraction of the total is required. For example, during combat only 25 percent of the Class IV supplies for a position might be required since the time

Table 5-2 The User Interface of the Class IV Model C4

DIVISIONS DEPLOYED	
TYPE	NBR
ARMOR	2
MECHANIZED	3
INFANTRY (LT)	0
AIRBORNE	0
AIR ASSAULT	0
ACR	1
ARMOR SEP BDE	1
MECH SEP BDE	0
INF(LT) SEP BDE	0

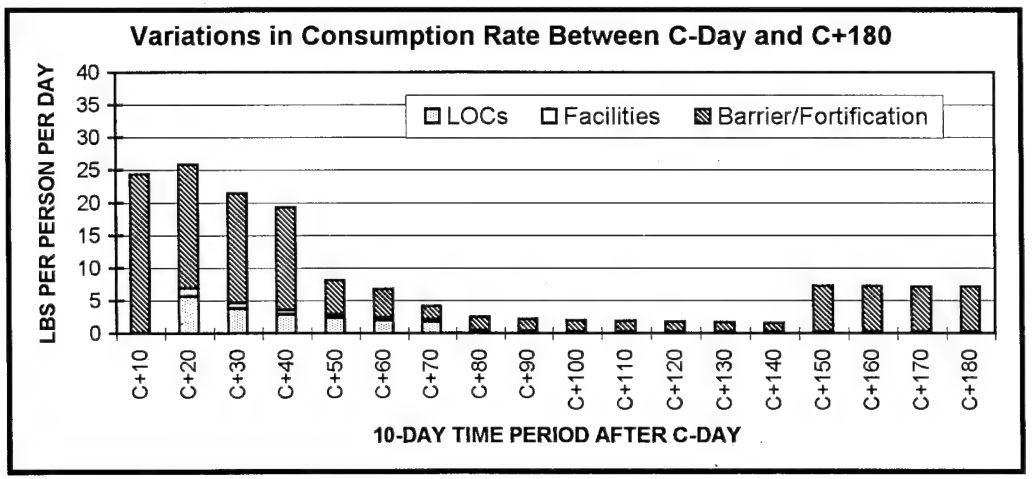
SCENARIO CONDITIONS

Miles from port to FEBA:	200
Number of days to deploy half of force:	60
Length of conflict in days:	180
Size of initial force:	5,000

Unit Movement Pattern: ○ Stationary ◉ Withdraw,defend,attack ○ Every 20 days

Level of Infrastructure: ○ Austere ○ Developing ◉ Well developed

Threat's Deep Strike Capability: ◉ None ○ Moderate ○ High



OUTPUT

TOTAL ARMY POPULATION:	245,188
TOTAL POUNDS CONSUMED:	157,983,546
Divisional B/F:	63,147,970
Nondivisional B/F:	72,832,348
Base Development:	22,003,229
RATE FOR ALL MATERIALS:	8.585
RATE FOR LOCAL CY:	0.012
CLASS IV RATE:	8.437
Base Development	1.375
Barrier/Fortification	7.062

ONE-PAGE ESTIMATE:	8.829
% difference with C4:	5%
lb difference vs C4:	0.392

and the ability to develop a position are limited, while the establishment of a new line of defense might consume 100 percent of the requirement. The "unit movement" row determines the barrier/fortification requirement level for each 10-day period. The user may choose to set a specific movement pattern by altering the "unit movement" row on the Workload sheet or may choose one of three default patterns from the User Interface sheet.

The first Class IV requirement computed by the Workload sheet is for barrier and fortification supplies. This calculation uses the divisional and nondivisional population, changes in population, unit movement, and levels of infrastructure and enemy capability to determine the supply requirement for each 10-day period. Enemy capability determines whether or not overhead cover is required. The level of infrastructure determines if nondivisional units require supplies for field latrines.

The remainder of the Workload sheet contains a block of cells for each base development task. The structure of the task blocks follows a standard pattern:

1. Calculate the requirement for the task in the current time period,
2. Subtract the portion of the requirement met by existing infrastructure and facilities constructed in earlier time periods,
3. Add to the requirement the portion of facilities in use but damaged in the preceding time period,
4. Constrain the requirement by the maximum number of new facilities that can be built in a 10-day period and by the portion of the requirement that can be met with host nation or contractor resources, and
5. Calculate the weight of Class IV supplies to meet the resulting task workload requirement.

The weight of Class IV supplies for each unit task was determined separately and is represented in C4 as a constant cell entry in each task block of the Workload sheet. Appendix F contains a description of the facilities required for each task and a complete listing of the bill of materials used to determine the weight of Class IV materials required per unit task. As with the calculations for the TAA scenarios, the weight of materials needed to perform a single task was computed by choosing a representative method that used minimal materials. In almost all cases, the weight corresponds to that used for the same task in the calculations described in Chapter 3. The information in Appendix F is provided to show that a credible weight requirement had been calculated and not to imply that the method chosen was the most appropriate for all cases.

The Workload sheet determines the total Class IV requirement by summing the individual task requirements for each 10-day period. It is easy to infer that the limited input data described thus far is not sufficient for such a detailed calculation. A number of simplifying assumptions had to be made. These were carefully documented on the third major spreadsheet in C4.

The Simplifying Assumptions (SA) Sheet

For each of the task calculations, assumptions had to be made regarding specific factors affecting the requirement, the level of damage, the portion of the requirement met by existing facilities, and the level of support from host nation or contractor resources. These assumptions were recorded on the SA sheet. The formulas on the Workload sheet directly referenced the value of the corresponding parameter as it was documented and stored on the SA sheet. Changes in the assumptions affect the overall Class IV consumption as soon as the spreadsheet recalculates its cells. One of the most important sets of parameters on the SA sheet indicates the level of host nation/contractor support available for each base development task. Like the unit movement row on the Workload sheet, the host nation/contractor assumptions have a substantial effect on Class IV requirements. These assumptions allow task performance to be turned on and off (0,1) or for input to determine the fraction of the task to be performed by host nation or contractor (values between 0 and 1). The input for host nation/contractor support was not placed on the User Interface sheet to maintain the simplicity of the interface, but it is fully accessible on the SA sheet.

The three summary spreadsheets included in C4 are used to accumulate the material requirements by task and to calculate the total overall consumption and the average Class IV consumption rate, which are used as output data for the User Interface sheet.

Verification of C4

The C4 model provides an experimental environment in which to observe how the Class IV consumption rate varies as different input parameters are altered. To verify that the model had been properly constructed and that its results are credible, C4 input data was configured to represent each of the scenarios used in the first phase of the study, and the output data was compared to the calculated results obtained earlier. Configuration of the C4 input for each scenario included matching the unit movement row to the scenario unit movement pattern, adjusting the host nation/contractor support assumptions to agree with the FASTALS engineer workload percentages, and setting the SA assumption regarding the ratio

of nondivisional to divisional population so that the final population was sufficiently close to the actual scenario population. Table 5-3 contains a summary of these results. Given the large amount of information lost in moving from the very detailed calculations used for FASTALS and ODS to the more general calculations used by C4, the final numbers are remarkably close.

The MRCE consumption rate computed by C4 is between the average consumption rate and the uniformly distributed rate computed earlier (Table 3-11). The difference results primarily from the surges in population growth during the actual scenario that were not replicated in C4, which assumed a relatively uniform population growth. The length of the ODS contingency was adjusted to include only the interval from C-Day to the end of hostilities, which was a truer representation of the requisition history than had been used initially.

Table 5-3 Comparison of Results from First Phase with C4 Output
TAA-2001 Scenarios and Operation Desert Shield/Storm

	CALCULATED DURING FIRST PHASE	C4 OUTPUT
EUROPE		
Number of days	35	40
Total Population	598,323	600,992
Total Pounds Consumed	397,201,587	404,776,589
Average Class IV Consumption Rate	19.65	19.18
MRCW		
Number of days	140	140
Total Population	252,275	253,306
Total Pounds Consumed	359,766,440	370,725,353
Average Class IV Consumption Rate	15.90	15.22
MRCE		
Number of days	115	120
Total Population	435,234	439,454
Total Pounds Consumed	628,426,621	643,589,208
Average Class IV Consumption Rate	22.35	19.06
ODS		
Number of days	198	180
Total Population	245,000	253,108
Total Pounds Consumed	218,296,307	206,750,766
Average Class IV Consumption Rate	9.00	10.86

Analysis of C4 Scenarios

The favorable results achieved in using C4 to replicate the Class IV requirements of the study's four known contingencies and the confidence gained from knowing how C4 had been structured and from observing the model in action supported the premise that it could be used to study how the consumption rate varied as input factors were changed. In particular, a large set of sample scenarios was collected from C4 and analyzed to determine relationships between the significant factors. These sample scenarios—defining conditions and associated Class IV requirement and consumption rate—are listed in Appendix G. The number of possible combinations of conditions was too large to manage, so several assumptions were made to narrow the number of situations to be considered. These assumptions were:

- the divisional forces would be structured into two cases: (1) a heavy force of 2 armor and 3 mechanized divisions with an armored cavalry regiment (ACR) and a separate armor brigade, and (2) a light force of 3 light infantry divisions, an airborne division, and an air assault division with an ACR and a separate mechanized brigade,

- the only base development tasks not fully supported by host nation or contractor resources were construction, maintenance, and repair of airports, roads, pipelines, supply storage facilities, EPW camps, and DEPMEDs;

- movement patterns would be limited to three cases of low (L) and high (H) movement periods: (1) a stationary force requiring only a single original position, denoted LLL, (2) a force moving in the pattern observed in the TAA scenarios of withdraw, defend and build, then attack, denoted HLH, and (3) a force moving to a new location every 20 days, denoted HHH. NOTE: In both MRCE and MRCW, the unit movement pattern was much the same. An initial response force withdrew to new positions during each 10-day period from C-Day to C+30. Then unit locations remained stable for the next 60 to 90 days while the force grew. Finally, a decisive force attacked, moving quickly to a number of ever-advancing positions over the course of 20 to 25 days. This unit movement pattern appears to be typical of current operational flow. Except for shifts in the time frames and an unaggressive enemy, ODS fits the pattern as well—at least well enough as far as the Class IV consequences are concerned.

The C4 input was configured for each of the combinations indicated in Appendix G, and the output was collected in a scenario spreadsheet. These 486 sample sets

were then studied to identify patterns of relationships. As noted in the initial observations, the factors affecting the Class IV consumption rate are not independent, and several are more qualitative than quantitative in nature. The best results were achieved by taking a "controlled experiment" approach instead of a purely mathematical one. Pairwise comparison of observations that were alike in all but one factor indicated that a multiplicative model was very promising. With that in mind, the spreadsheet was expanded to introduce variables for each value of the scenario factors for a heavy force and for a light force. These factors included: the length of conflict, the level of infrastructure, the enemy long-distance strike capability, the size of the initial force, and the number of days to deploy the first half of the force. Because of their close interrelationships, the level of infrastructure and the enemy capability were considered jointly, resulting in nine different variables representing the nine combinations of three levels of infrastructure and three levels of enemy capability. Each scenario was then given a predicted Class IV consumption rate expressed in terms of five variables (four appropriate to the scenario from the categories already mentioned and a base consumption rate to match the scenarios force). EXCEL's "Solver" feature was then applied to determine values for the variables to minimize:

$$\sum_{S=1}^{486}(C4R_S - PR_S)^2$$

where $C4R_S$ is the Class IV consumption rate calculated by C4 for scenario S and PR_S is the predicted rate for scenario S expressed in terms of the variables for the appropriate scenario factors. The solution set resulting from this optimization procedure is very intuitive for all but one of the factors: the size of the initial force. The scenario set had samples for only three sizes for the initial force: 5K, 20K, and 50K. To expand the results to include other force sizes, a curve was fitted to the three known data points—a linear approximation was not suitable. The multiplicative factors determined by this optimization procedure were used to develop the algorithm described in Table 5-4. Applying this algorithm to the scenarios in the C4 sample yields Class IV consumption rates that are within 15 percent of the C4 rate for all but 43 of the 486 scenarios. These 43 cases are characterized by a large initial force in a stationary movement pattern—a situation that results in a Class IV consumption rate well below the base rate. In this situation, the predicted rate is within 2.4 pounds of the C4 rate but the percent difference is high because the rate is so small. For the other scenarios, with consumption rates varying from 3.39 to 27.94 pounds per person per day, the algorithm yields very good results. The C4 sample also tracked the consumption

TABLE 5-4 METHOD FOR COMPUTING A CONTINGENCY-SPECIFIC CLASS IV PLANNING FACTOR

A Class IV consumption rate for the first 180 days of a **major regional contingency** may be computed by using the following formula with factors from the appropriate tables below. This method assumes base development tasks are limited to airfields, roads, pipelines, supply storage facilities, EPW camps, and DEPMEDs using austere initial standard construction. This method does not apply to operations other than war (OOTW).

CLASS IV CONSUMPTION RATE = **BASE RATE** X **CONTINGENCY FACTOR** X **MANEUVER FACTOR** X **DEPLOYMENT RATE FACTOR** X **INITIAL FORCE FACTOR**

HEAVY FORCE

BASE RATE: **6.50** LB/PERSON/DAY

CONTINGENCY FACTOR:

THEATER	THREAT'S DEEP STRIKE CAPABILITY: None	Moderate	High
Well-developed	1.00	1.23	1.34
Developing	1.30	1.63	1.81
Austere	1.31	1.75	2.03

MANEUVER FACTOR:

Stationary	1.00
Withdraw/Defend/Attack	1.48
Move Every 20 Days	1.76

LIGHT FORCE

BASE RATE: **7.25** LB/PERSON/DAY

CONTINGENCY FACTOR:

THEATER	THREAT'S DEEP STRIKE CAPABILITY: None	Moderate	High
Well-developed	1.00	1.26	1.38
Developing	1.28	1.65	1.87
Austere	1.30	1.80	2.13

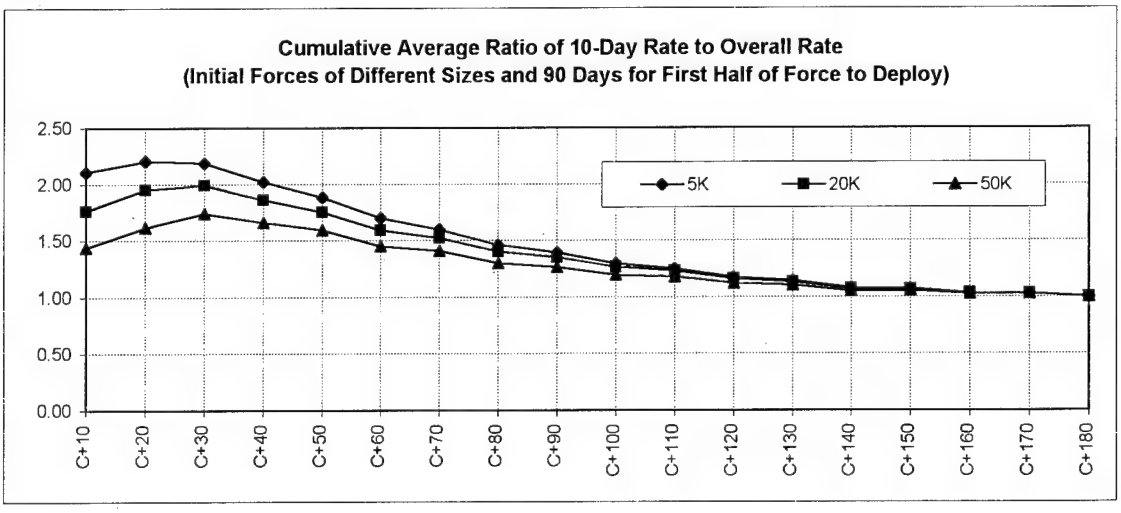
MANEUVER FACTOR:

Stationary	1.00
Withdraw/Defend/Attack	1.50
Move Every 20 Days	1.77

DEPLOYMENT RATE FACTOR: $(.975)^D$ where D = 0.1 X (90 - Number days to deploy half of force) and D is rounded to nearest integer

INITIAL FORCE FACTOR: $1.019 - 6.0\ T/1000 + 2.18\ T^2/100000$ where T = number of 1000s of troops present on C-Day

The consumption rate varies for different time periods during the 180 days by the multiplicative factors indicated in the graph below. Compute a rate for contingencies shorter than 180 days by multiplying the rate from above by the corresponding factor from the graph. Example: for 70-day contingency with 20K initial force, use 1.5 as multiplier.



rate for each of the 10-day periods. This data confirmed earlier observations that the consumption rate during the interval from C-day to C+30 can be as much as 2.3 times the overall rate.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

The following statements summarize the study's findings and conclusions:

1. The Class IV consumption rate varies not only from contingency to contingency but also across the different phases of a single contingency. A single planning factor cannot accurately represent the Class IV requirements of the variety of contingencies currently being planned and analyzed. The current study found no pattern to the Class IV requirement to support the decomposition of the overall planning factor into a portion for barriers and fortifications and a portion for base development, as had been suggested in the Class IV planning factor method published in the 1987 edition of FM 101-10-1/2. In the three TAA-2001 scenarios, for which detailed calculations were made, the base development portion ranges from under 20 percent to almost 50 percent of the total. Also, the Class IV planning factor methodology published in FM 101-10-1/2 in the edition prior to the 1987 volume suggested that the Class IV planning factor of 8.5 lb/person/day was to be multiplied by the following factors for each time period prior to D+180:

Period	Factor Multiplier
D-day to D+30	2.4
D+31 to D+120	1.6
D+121 to D+180	1.4
D+181 and after	1.0

The current study's findings are very close to this in specifying how the consumption rate varies during the first 180 days. The graph at the bottom of the study's proposed one-page method (Table 5-4) indicates the following multipliers for an initial force of 5000:

Period	Factor Multiplier
C-day to C+30	2.2
C+31 to C+120	1.6
C+121 to C+180	1.1
C+181 and after	1.0

The study did not include researching the history of why this portion of the Class IV planning factor was omitted from the 1987 listing in FM 101-10-1/2, but the study's findings indicate that this omission should not have occurred.

2. The Class IV requirement is most dependent upon:
   - the type of forces deployed (heavy or light),
   - the threat's capabilities,
   - the force deployment rate,
   - the force movement rate, and
   - the percent of the LOC/facility requirement met by the existing infrastructure or through the use of host nation or contractor resources.

3. The results of a detailed calculation of the Class IV consumption rates for Europe, Major Regional Contingency-West (MRCW), and Major Regional Contingency-East (MRCE) as determined by the scenario data used for the FASTALS model in support of TAA-2001 are given in Table 6-1.

Table 6-1 Class IV Consumption Rates for TAA-2001 Scenarios

CONSUMPTION RATES (LB/PERSON/DAY)	EUROPE	MRCW	MRCE
Overall Average Class IV Consumption Rate	19.65	15.90	22.35
Base Development	3.71	5.86	10.61
Barrier/Fortification	15.94	10.04	11.73

4. The Class IV planning factor has the potential for being self-predicting. That is, instead of providing a good estimate of the quantity of Class IV supplies that will be required for a contingency, the planning factor may actually determine the quantity of Class IV materials available. This occurs because current planning and analysis methods do not have a direct link between the engineer systems and the logistics systems. The Class IV requirements resulting from detailed engineer plans are not communicated to the logistics system to support estimates of the material hauling and handling requirements. Instead, the logistics systems use Class IV planning factors.

5. The study was able to produce a simple, one-page methodology for computing a contingency-specific Class IV planning factor (Table 5-4). This algorithmic approach is based on analysis of a large sample of scenario requirements generated by a Class IV spreadsheet model developed by USACERL.

The study recommends the adoption of the Class IV planning factor methodology illustrated in Table 5-4 for use in current models requiring a single Class IV consumption rate. The study also recommends that automated systems used for OPLAN preparation or military analysis be enhanced by establishing direct links between the engineer and logistics subsystems, replacing the use of the Class IV planning factor for the logistics estimates with a more precise engineer calculation of the specific requirement.

METRIC CONVERSION TABLE

1 in.	=	25.4 mm
1 ft	=	0.305 m
1 lb	=	0.453 kg
1 cu ft	=	0.028 m^3
1 mi	=	1.61 km
1 sq ft	=	0.093 m^2
1 gal	=	3.78 L
1 yd	=	0.9144 m
1 pint	=	0.4732 L
1 quart	=	0.9463 L

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ACRONYMS and INITIALIZATIONS

ACR	armored cavalry regiment
ADA	air defense artillery
AFCS	Army Facilities Components System
AFPDA	Army Force Planning Data and Assumptions
AITF	Army-in-the-Field
AMDF	Army Master Data File
AO	area of operations
AR	Army Regulation
B/F	barriers and fortifications
BOM	bill of materials
CAA	U.S. Army Concepts Analysis Agency
CESP	Civil Engineer Support Plan
CESPG	CESP Generator
EAC	echelons above corps
ENCOM	Engineer Command
EPW	enemy prisoner of war
ESSC	Engineer Strategic Studies Center

FASTALS	Force Analysis Simulation of Theater Administrative and Logistics Support
FEBA	forward edge of battle area
FM	Field Manual
HQDA	Headquarters, Department of the Army
JCS	Joint Chiefs of Staff
JEPES	Joint Engineering Planning and Execution System
LEE	labor and equipment estimate
LIF	Logistics Intelligence File
LOCs	lines of communication
LOGPLANS	Logistic Plans
LOGSA	U.S. Army Logistics Support Activity
LSA	Logistical Sustainability Analysis
MEAPO	Middle East/Africa Projects Office
METL	mission essential task list
METT-T	mission, enemy, troops, terrain and weather, time available
MOS	military occupational speciality
MRCE	Major Regional Contingency-East
MRCW	Major Regional Contingency-West
MRG	Movement Requirements Generator
NEA	northeast Asia
NSN	national stock number

ODS	Operation Desert Shield/Storm
ODSCOPS	Office of the Deputy Chief of Staff, Operations
OPLANS	Operation Plans
POL	petroleum, oils, and lubricants
RELMS	rapidly-erectable, lightweight mobilization structures
SRC	standard requirement code
STON	short ton
SWA	southwest Asia
TAA	Total Army Analysis
TFE	Transportation Feasibility Estimator
TO	theater of operations
TOGS	theater-oriented guide specifications
TPFDD	Time-Phased Force and Deployment Data
USACERL	U.S. Army Construction Engineering Research Laboratories

APPENDIX A: Manhour and Material Requirement for AFCS Facilities Used in FASTALS

The calculation of the Class IV requirements associated with the three TAA-2001 scenarios was dependent on establishing a "per unit task" requirement for manhours and materials for each base development task. To do this, the study relied on previous work completed by ESSC to determine the FASTALS engineer workloads. ESSC linked the performance of each task to specific sets of AFCS facilities and determined the manhour requirement for a task by totaling the manhour requirements for each of its component facilities. The current study used a parallel process to determine the supply requirements for each task. The table on the following three pages contains a complete list of the AFCS facilities used for the FASTALS engineer workloads, with the leftmost column indicating the appropriate FASTALS task number. The manhour and materials requirements for each facility were taken directly from the AFCS database. The supply requirements are given in short tons in keeping with the level of aggregation used in FASTALS.

Manhour and Material Requirements for AFCS Facilities Used for FASTALS

TASK	FACILITY DESCRIPTION	FACILITY NO	HORIZONTAL MANHOURS	VERTICAL MANHOURS	GENERAL MANHOURS	TOTAL STON	CLASS II STON	CLASS IV STON	CLASS VII STON	CLASS IX STON	LOCAL CU YD
1	Crater repair	11100CE	13.00	0.00	18.00	0.00	0.00	0.00	0.00	0.00	14
1	Culvert--Europe	85290AM	32.00	0.00	144.00	6.15	0.00	6.15	0.00	0.00	27
1	Culvert--SWA & NEA	85290AV	60.00	0.00	270.00	12.33	0.00	12.33	0.00	0.00	54
1	Road surface 1 mile	85110BN	241.00	0.00	68.00	0.00	0.00	0.00	0.00	0.00	2737
2	80-ft Bailey bridges (2)	85120HE	110.00	0.00	127.00	4.07	0.00	0.07	4.00	0.00	0
2	Pier (1)	85120EC	50.00	101.00	105.00	31.92	0.14	26.45	0.00	5.33	0
3	Railroad repair 1 mile	86010YA	1818.00	0.00	4752.00	0.00	0.00	0.00	0.00	0.00	0
4	Span (40 ft) and pier	86030TP	130.00	588.00	432.00	26.73	0.00	25.31	0.00	1.42	0
5	6 in aluminum pipe 200 ft	12520AD	4.00	28.00	32.00	1.06	0.00	1.06	0.00	0.00	0
5	Bolted steel pipe 200 ft	12510YA	20.00	48.00	48.00	1.69	0.12	0.00	0.00	1.57	0
5	6 or 8 in pump station	12530BB	11.00	80.00	60.00	14.99	0.12	11.70	3.09	0.08	0
5	500 ft critical gap crossing	12592HH	24.00	72.00	96.00	5.60	0.00	5.60	0.00	0.00	0
6	Port damage repair	15250AU	390.00	1020.00	1020.00	29.24	0.03	29.05	0.00	0.17	0
7	50000 gal refuel system	12110AN	60.00	0.00	0.00	8.22	0.02	3.37	1.04	3.79	0
7	Runway Lighting 8000 ft	13610AA	0.00	84.00	60.00	22.04	0.00	22.04	0.00	0.00	0
7	Flight control tower	13315BA	1.00	487.00	97.00	14.57	0.05	13.82	0.00	0.71	5
7	Crater repairs (3)	11150AF	90.00	12.00	144.00	57.58	0.00	30.54	27.04	0.00	288
8	Cesspool	83190AA	11.00	100.00	156.00	4.30	0.00	4.14	0.00	0.16	46
8	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
8	Road preparation 1 mile Europe	85130FA	2086.00	0.00	830.00	14.32	0.00	13.80	0.00	0.53	0
8	Road preparation 1 mile SWA & NEA	85130FW	6850.00	0.00	2719.00	27.48	0.00	23.79	0.00	3.69	0
8	Road surface 1 mile	85110BM	189.00	0.00	64.00	0.00	0.00	0.00	0.00	0.00	1807
8	Hardstand prep 1000 sy Europe	85210AU	203.00	0.00	73.00	0.00	0.00	0.00	0.00	0.00	0
8	Hardstand prep 1000 sy SWA & NEA	85210BR	594.00	0.00	184.00	18.61	0.00	18.61	0.00	0.00	0
8	Hardstand surface 1000 sy	85110DF	24.00	0.00	8.00	0.00	0.00	0.00	0.00	0.00	111
9	Hardstand 1000 sy Europe & NEA	85210BC	297.00	0.00	119.00	7.15	0.00	7.15	0.00	0.00	0
9	Road hardstand 1000 sy SWA	85210AH	198.00	0.00	68.00	2.72	0.00	2.72	0.00	0.00	0
9	Latrine	72321CB	0.00	2.00	2.00	0.12	0.00	0.12	0.00	0.00	0
9	40 ft X 100 ft general admin bldg	61050JN	64.00	449.00	244.00	16.97	0.91	13.05	1.24	1.77	58
9	40 ft X 50 ft general admin bldg	61050HN	29.00	153.00	77.00	9.27	0.46	7.20	0.69	0.93	30
9	Electrical distribution 25000 sf	81240BL	48.00	474.00	98.00	2.71	0.03	2.34	0.00	0.34	0
9	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
10	Warehouse	44222BD	46.00	741.00	555.00	40.15	0.00	39.88	0.00	0.26	21
10	Warehouse	44222BR	121.00	2182.00	1506.00	113.97	0.00	113.16	0.00	0.81	52
10	Latrine	72321DB	8.00	58.00	20.00	1.83	0.00	1.73	0.00	0.10	0
10	Fire protection sump 10000 gal	84330AC	16.00	108.00	116.00	2.87	0.00	2.87	0.00	0.00	14
10	Road	85110AT	274.00	0.00	76.00	0.00	0.00	0.00	0.00	0.00	3129
10	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
11	Hardstand 1000 sy Europe	85210AY	215.00	0.00	77.00	7.15	0.00	7.15	0.00	0.00	0
11	Hardstand prep 1000 sy SWA & NEA	85210BR	594.00	0.00	184.00	18.61	0.00	18.61	0.00	0.00	0

TASK	FACILITY DESCRIPTION	FACILITY NO	HORIZONTAL MANHOURS	VERTICAL MANHOURS	GENERAL MANHOURS	TOTAL STON	CLASS II STON	CLASS IV STON	CLASS VII STON	CLASS IX STON	LOCAL CU YD
11	1-lane road prep 1 mile Europe	85130KH	1752.00	0.00	639.00	11.61	0.00	11.18	0.00	0.43	0
11	1-lane road prep 1 mile SWA & NEA	85130LC	4840.00	0.00	1887.00	22.16	0.00	19.19	0.00	2.98	0
11	2-lane road prep 1 mile Europe	85130FD	2265.00	0.00	905.00	14.32	0.00	13.80	0.00	0.53	0
11	2-lane road prep 1 mile SWA & NEA	85130FW	6850.00	0.00	2719.00	27.48	0.00	23.79	0.00	3.69	0
11	Road surface 1 mile	85110BN	241.00	0.00	68.00	0.00	0.00	0.00	0.00	0.00	2737
11	2-lane road paving 1 mile	85110AT	274.00	0.00	76.00	0.00	0.00	0.00	0.00	0.00	3129
12	Cold storage hardstand 4000 cf	43191YB	183.00	0.00	68.00	0.00	0.00	0.00	0.00	0.00	56
13	POL tank (10000 bbl w/8in line)	41180AK	140.00	850.00	430.00	2.53	0.87	0.06	0.42	1.17	0
13	POL tank (3000 bbl w/6in line)	41180AH	90.00	310.00	220.00	2.28	0.87	0.06	0.17	1.17	0
13	POL tank (1000 bbl w/4 in line)	41180AE	80.00	320.00	130.00	1.27	0.41	0.02	0.10	0.75	0
13	POL tank (250 bbl w/4in line)	41180AB	25.00	100.00	45.00	5.14	0.41	0.04	3.93	0.77	0
13	BRM/DRN Assemble (10000 bbl)	41180AJ	140.00	850.00	420.00	2.15	0.00	0.60	0.42	1.12	0
13	BRM/DRN Assemble (3000 bbl)	41180AG	90.00	310.00	210.00	1.92	0.00	0.55	0.17	1.20	0
13	Tank pump (2800 BPH)	12530AK	5.00	40.00	15.00	0.95	0.27	0.01	0.00	0.68	0
13	Switch manifold (6 in w/o pump)	12510AB	10.00	150.00	50.00	9.10	3.65	2.34	0.00	3.11	0
13	Switch manifold (8 in w/o pump)	12510AC	10.00	180.00	60.00	16.09	6.45	7.21	0.00	2.43	0
13	Tank pump (700 BPH)	12510AJ	5.00	35.00	10.00	4.56	1.78	0.09	2.30	0.39	0
13	Transfer pump (1400 BPH)	12510AP	35.00	245.00	50.00	11.63	2.18	4.66	2.30	2.49	0
13	API pipe (1000 ft w/8 in diameter)	12510BK	10.00	200.00	140.00	13.08	0.54	0.00	0.00	12.54	0
13	Lightweight tubing (1000 ft w/8in)	12510AV	10.00	110.00	60.00	6.20	0.54	0.02	0.00	5.64	0
13	Flood pump (785 BPH w/8 in dia)	12510AE	10.00	215.00	55.00	10.25	1.68	1.77	4.60	2.21	0
13	Lightweight tubing (1000 ft w/6 in dia)	12510AU	10.00	75.00	45.00	6.15	4.43	0.00	0.00	1.72	0
13	Flood pump (1335 BPH w/8 in diameter)	12510AF	20.00	280.00	80.00	11.24	0.34	3.93	4.60	2.38	0
13	API pipe (1000 ft w/6 in diameter)	12510BJ	5.00	115.00	70.00	11.19	0.00	0.00	0.00	11.19	0
13	Tank pump (700 BPH w/6 in dia)	12510AH	5.00	35.00	10.00	3.84	0.14	1.03	2.30	0.36	0
13	Transfer pump (700 BPH w/6 in dia)	12510AN	30.00	230.00	50.00	11.18	4.87	1.36	2.30	2.65	0
13	Hardstand (350 sy) and facility (800 sf)	61050YA	128.00	0.00	48.00	0.00	0.00	0.00	0.00	0.00	45
13	Security fence	87210AR	48.00	222.00	224.00	4.14	0.00	4.14	0.00	0.00	0
13	Security gate	87210AT	8.00	120.00	48.00	0.61	0.00	0.59	0.00	0.02	251
13	Fuel sys sup pt (120000 gal)	12640BA	62.00	82.00	68.00	16.28	0.03	3.07	5.37	7.81	0
14	Guard tower	87220AA	7.00	72.00	44.00	2.81	0.00	2.78	0.00	0.03	0
14	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
14	1000 sy hardstand	85210AG	63.00	0.00	20.00	2.72	0.00	2.72	0.00	0.00	0
14	Road 1 mile	85130JR	666.00	0.00	209.00	6.02	0.00	5.08	0.00	0.94	0
14	1000 ft fence	87210CE	16.00	98.00	340.00	7.27	0.00	7.27	0.00	0.00	5
14	1000 ft barbed tape	87210AD	28.00	0.00	112.00	1.85	0.00	1.85	0.00	0.00	0
14	Personnel gate	87210CR	6.00	0.00	6.00	0.17	0.00	0.16	0.00	0.01	0
14	Vehicle gate	87210CF	15.00	0.00	15.00	0.41	0.00	0.27	0.00	0.15	0
14	Electrical distribution	81240CG	150.00	370.00	220.00	20.94	0.66	9.86	4.76	5.45	0
14	Personnel light	81230AH	0.00	12.00	0.00	0.06	0.02	0.00	0.00	0.03	0

Manhour and Material Requirements for AFCS Facilities Used for FASTALS

Manhour and Material Requirements for AFCS Facilities Used for FASTALS

TASK	FACILITY DESCRIPTION	FACILITY NO	HORIZONTAL MANHOURS	VERTICAL MANHOURS	GENERAL MANHOURS	TOTAL STON	CLASS II STON	CLASS IV STON	CLASS VII STON	CLASS IX STON	LOCAL CU YD
15	Concertina wire 300 ft	87210AY	1.00	106.00	2.00	1.03	0.00	1.03	0.00	0.00	0
15	Electrical distribution 1 mile	81240GB	125.00	1035.00	640.00	18.66	0.09	16.64	0.00	1.93	0
15	Latrine	72321CB	0.00	2.00	2.00	0.12	0.00	0.12	0.00	0.00	0
15	Road 1 mile	85130GP	730.00	0.00	247.00	1.11	0.00	0.69	0.00	0.43	0
15	Earthen revetment	14910GA	67.00	0.00	17.00	0.52	0.00	0.52	0.00	0.00	0
15	Hardstand 1000 sy	61050YA	128.00	0.00	48.00	0.00	0.00	0.00	0.00	0.00	45
15	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
16	Latrine	72321CB	0.00	2.00	2.00	0.12	0.00	0.12	0.00	0.00	0
16	Hardstand 1000 sy	85210BF	327.00	0.00	118.00	11.01	0.00	11.01	0.00	0.00	0
16	Class B road 1 mile	85130FK	3347.00	0.00	1477.00	20.51	0.00	16.82	0.00	3.69	0
16	Fire protection sump 10000 gal	84330AC	16.00	108.00	116.00	2.87	0.00	2.87	0.00	0.00	14
16	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
16	Electrical distribution 500 bed	81240BA	365.00	5430.00	1685.00	21.62	0.66	18.06	0.00	2.90	0
16	Water distribution 500 bed	84210AU	200.00	900.00	900.00	4.49	0.00	2.47	0.00	2.02	11
17	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
17	10-bed dispensary	55020BL	44.00	150.00	80.00	62.58	0.65	59.83	0.78	1.33	34
17	1300 sy hardstand	55020YC	476.00	0.00	177.00	14.31	0.00	14.31	0.00	0.00	145
17	Latrine	72321CB	0.00	2.00	2.00	0.12	0.00	0.12	0.00	0.00	0
17	Dental clinic	54010AH	110.00	369.00	116.00	69.60	0.64	59.55	7.76	1.65	39
17	110 sy hardstand	54010YA	403.00	0.00	150.00	12.11	0.00	12.11	0.00	0.00	122
18	60 ft X 60 ft maintenance interior	21410AD	0.00	133.00	81.00	1.07	0.00	0.60	0.00	0.46	0
18	60 ft X 60 ft metal building	93143AG	198.00	980.00	188.00	12.25	0.00	0.00	12.25	0.00	0
18	1000 sf concrete floor	93191GG	1.94	46.11	16.11	4.53	0.02	4.24	0.00	0.27	20
18	60 ft X 80 ft maintenance interior	21410AH	0.00	150.00	95.00	1.44	0.00	0.86	0.00	0.58	0
18	60 ft X 80 ft metal building	93143AR	240.00	1260.00	280.00	16.00	0.00	0.00	16.00	0.00	0
19	Cesspool	83190AA	11	100	156	4.30	0.00	4.14	0.00	0.16	46
19	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
19	Road prep 1 mile Europe	85130FA	2086.00	0.00	830.00	14.32	0.00	13.80	0.00	0.53	0
19	Road prep 1 mile SWA & NEA	85130FW	6850.00	0.00	2719.00	27.48	0.00	23.79	0.00	3.69	0
19	Road surface 1 mile	85110BM	189.00	0.00	64.00	0.00	0.00	0.00	0.00	0.00	1807
19	Hardstand prep 1000 sy Europe	85210AU	203.00	0.00	73.00	0.00	0.00	0.00	0.00	0.00	0
19	Hardstand prep 1000 sy SWA & NEA	85210BR	594.00	0.00	184.00	18.61	0.00	18.61	0.00	0.00	0
19	Hardstand surface 1000 sy	85110DF	24.00	0.00	8.00	0.00	0.00	0.00	0.00	0.00	111
20	Road hardstand 1000 sy Europe	85210BC	297.00	0.00	119.00	7.15	0.00	7.15	0.00	0.00	0
20	Road hardstand 1000 sy SWA & NEA	85210AH	172.00	0.00	59.00	2.72	0.00	2.72	0.00	0.00	0
21	Road maintenance 100 miles for 30 days	85140AE	3600.00	0.00	4800.00	4.87	0.00	4.87	0.00	0.00	0
22	Railroad maint 1 mile per day Eur & NEA		1.00	1.00	1.00	2.92	0.00	2.91	0.00	0.02	0.00
22	Railroad maint 1 mile per day SWA		1.25	1.25	1.25	2.92	0.00	2.91	0.00	0.02	0.00
23	Port maintenance		39	102.00	102.00	2.92	0.00	2.91	0.00	0.02	0.00

APPENDIX B: COMMZ Base Development Class IV Consumption by Task for TAA-2001 Scenarios

The tables on the following six pages contain two sets of data for each of the TAA-2001 scenarios. The first set (lefthand pages) represents the study's original calculations, which used the facilities listed in Appendix A and the FASTALS output regarding engineer manhour requirements for each task per day by time period for each scenario. These tables were reviewed by engineer planners at the 412th and 416th ENCOMs. Based on their feedback, two changes were made to the calculations. First, some of the facilities used to determine the workload factors were changed to reflect current construction practices. These changes are indicated in Appendix C. Second, the requirement for airfield work was added. Subject matter experts indicated that, when the Army provides engineer support to the Air Force, the Army is responsible for requisitioning and transporting the necessary supplies. FASTALS allows representation of Army support to the Air Force, but only at a low level of detail. The calculation for the supply requirement for airfield work was made by reconstructing study guidance and deriving a "pounds per engineer manhour" rate as explained in Chapter 3. The corrected tables (righthand pages) for each scenario contain the data used to determine the total Class IV requirement for the TAA scenarios.

COMMZ Base Development Class IV Consumption - Europe

Includes 23 Original FASTALS Tasks Only

		CLASS IV STON PER DAY DURING TIME PERIOD							
	TASK DESCRIPTION	2	3	4	5	6	7	8	9
1	Road damage repair	0.00	0.00	0.03	0.05	0.05	0.08	0.05	0.11
2	Highway bridge damage repair	0.00	0.00	5.65	12.56	6.91	11.31	3.14	3.14
3	Railroad damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Railroad bridge damage repair	0.00	0.00	13.21	21.35	11.67	15.19	7.48	8.14
5	Pipeline damage repair	0.00	0.00	0.00	0.53	0.44	0.75	0.35	0.44
6	Port damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Army Airfield damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Troop camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Admin space construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Gen supply storage construction	0.00	0.00	154.36	154.36	61.74	30.87	30.87	30.87
11	Ammunition storage construction	0.00	0.00	56.30	56.30	56.30	56.47	59.44	62.30
12	Refrigerated storage construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	POL storage construction	0.00	30.95	881.13	865.34	618.64	627.43	332.44	342.10
14	EPW camp construction	0.00	0.00	1.08	0.96	0.86	0.93	1.30	1.32
15	ADA site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	DEPMEDs site preparation	0.00	12.92	39.93	37.83	29.21	57.61	32.48	5.17
17	Dispensary/dental clinic construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Maintenance facility construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	Replacement camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Road hardstand construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	Road maintenance	0.10	0.06	0.02	0.06	0.04	0.07	0.05	0.09
22	Railroad maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	Port maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TOTAL PER DAY	**0.10**	**43.93**	**1151.70**	**1149.34**	**785.86**	**800.71**	**467.61**	**453.69**

		CLASS IV STON PER DAY DURING TIME PERIOD							
	TASK DESCRIPTION	2	3	4	5	6	7	8	9
1	Road damage repair	0.00	0.00	0.03	0.05	0.05	0.08	0.05	0.11
2	Highway bridge damage repair	0.00	0.00	5.65	12.56	6.91	11.31	3.14	3.14
3	Railroad damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Railroad bridge damage repair	0.00	0.00	13.21	21.35	11.67	15.19	7.48	8.14
5	Pipeline damage repair	0.00	0.00	0.00	0.53	0.44	0.75	0.35	0.44
6	Port damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Army Airfield damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Troop camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Admin space construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Gen supply storage construction	0.00	0.00	53.27	53.27	21.31	10.65	10.65	10.65
11	Ammunition storage construction	0.00	0.00	56.30	56.30	56.30	56.47	59.44	62.30
12	Refrigerated storage construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	POL storage construction	0.00	31.83	905.96	889.73	636.08	645.12	341.81	351.74
14	EPW camp construction	0.00	0.00	1.08	0.96	0.86	0.93	1.30	1.32
15	ADA site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	DEPMEDs site preparation	0.00	12.92	39.93	37.83	29.21	57.61	32.48	5.17
17	Dispensary/dental clinic construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Maintenance facility construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	Replacement camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Road hardstand construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	Road maintenance	0.10	0.06	0.02	0.06	0.04	0.07	0.05	0.09
22	Railroad maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	Port maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Airfields	0.00	554.35	554.35	277.13	277.13	277.13	277.13	277.13
	TOTAL PER DAY	**0.10**	**599.15**	**1629.79**	**1349.77**	**1039.99**	**1075.31**	**733.90**	**720.24**

COMMZ Base Development Class IV Consumption - Europe

Adjusted to Include Airfields and Recommended Changes in Facilities

COMMZ Base Development Class IV Consumption - MRCW

Includes 23 Original FASTALS Tasks Only

		CLASS IV STON PER DAY DURING TIME PERIOD																
	TASK DESCRIPTION	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Road damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
2	Highway bridge damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.00	0.00	0.00
3	Railroad damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Railroad bridge damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Pipeline damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.66	0.66	0.66	0.66	0.66	0.75	0.79	0.79	0.79	0.79
6	Port damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.12	0.12	0.24	0.12	0.00	0.12	0.00	0.00	0.00
7	Army Airfield damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Troop camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Admin space construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Gen supply storage construction	0.00	0.00	16.48	10.99	5.49	5.49	6.28	6.28	244.88	197.26	198.83	161.42	116.16	106.48	90.26	81.63	74.04
11	Ammunition storage construction	0.00	0.00	69.80	46.53	23.27	23.27	23.27	23.27	31.34	31.38	36.32	105.21	90.53	196.91	180.72	162.61	147.88
12	Refrigerated storage construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	POL storage construction	0.00	0.00	37.45	29.96	14.98	7.49	7.49	7.49	17.95	21.92	27.61	37.39	28.35	52.50	35.97	30.46	26.74
14	EPW camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	ADA site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	DEPMEDs site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.27	5.50	3.52	4.70	4.40	4.77	5.03	5.10	5.54
17	Dispensary/dental clinic construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Maintenance facility construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.36	9.82	8.13	7.59	6.61	12.59	26.34	21.52	17.68	14.55
19	Replacement camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Road hardstand construction	0.00	0.00	0.00	0.00	0.00	0.95	1.61	0.74	0.85	1.45	0.55	0.00	0.00	0.00	0.00	0.00	0.00
21	Road maintenance	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.02	0.02	0.03	0.03	0.02	0.05	0.02	0.01	0.01	0.01
22	Railroad maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	Port maintenance	0.00	0.00	0.00	0.00	0.00	0.48	0.24	0.12	0.36	0.36	0.48	0.24	0.12	0.60	0.24	0.24	0.24
	TOTAL PER DAY	0.00	0.00	123.74	87.48	43.74	37.70	40.29	44.47	313.81	267.40	276.43	316.96	253.54	389.11	334.59	298.57	269.86

		CLASS IV STON PER DAY DURING TIME PERIOD																
	TASK DESCRIPTION	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Road damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
2	Highway bridge damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.00	0.00	0.00
3	Railroad damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Railroad bridge damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Pipeline damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.66	0.66	0.66	0.66	0.66	0.75	0.79	0.79	0.79	0.79
6	Port damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.12	0.12	0.24	0.12	0.00	0.12	0.00	0.00	0.00
7	Army Airfield damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Troop camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Admin space construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Gen supply storage construction	0.00	0.00	5.69	3.79	1.90	1.90	2.17	2.17	84.51	68.07	68.62	55.71	40.09	36.75	31.15	28.17	25.55
11	Ammunition storage construction	0.00	0.00	69.80	46.53	23.27	23.27	23.27	23.27	31.34	31.38	36.32	105.21	90.53	196.91	180.72	162.61	147.88
12	Refrigerated storage construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	POL storage construction	0.00	0.00	38.51	30.81	15.40	7.70	7.70	7.70	18.46	22.53	28.39	38.45	29.15	53.98	36.98	31.32	27.50
14	EPW camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	ADA site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	DEPMEDs site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.27	5.50	3.52	4.70	4.40	4.77	5.03	5.10	5.54
17	Dispensary/dental clinic construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Maintenance facility construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.15	18.62	15.40	14.39	12.52	23.86	49.93	40.79	33.51	27.59
19	Replacement camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Road hardstand construction	0.00	0.00	0.00	0.00	0.00	0.95	1.61	0.74	0.85	1.45	0.55	0.00	0.00	0.00	0.00	0.00	0.00
21	Road maintenance	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.02	0.02	0.03	0.03	0.02	0.05	0.02	0.01	0.01	0.01
22	Railroad maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	Port maintenance	0.00	0.00	0.00	0.00	0.00	0.48	0.24	0.12	0.36	0.36	0.48	0.24	0.12	0.60	0.24	0.24	0.24
	Airfields	0.00	333.83	333.83	333.83	333.83	333.83	333.83	333.83	333.83	333.83	333.83	333.83	333.83	333.83	333.83	333.83	333.83
	TOTAL PER DAY	**0.00**	**333.83**	**447.83**	**414.96**	**374.39**	**368.14**	**370.22**	**379.19**	**496.57**	**479.94**	**487.61**	**552.05**	**523.37**	**678.27**	**629.59**	**595.63**	**568.98**

COMMZ Base Development Class IV Consumption - MRCW

Adjusted to Include Airfields and Recommended Changes in Facilities

COMMZ Base Development Class IV Consumption - MRCE

Includes 23 Original FASTALS Tasks Only

		CLASS IV STON PER DAY DURING TIME PERIOD														
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Road damage repair	0.00	0.00	3.82	3.54	3.02	2.81	2.90	2.90	3.42	0.00	0.00	0.00	0.00	0.00	0.00
2	Highway bridge damage repair	0.00	0.00	616.71	448.26	328.82	287.89	276.00	276.00	324.53	0.00	0.00	0.00	0.00	0.00	0.00
3	Railroad damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Railroad bridge damage repair	0.00	0.00	150.02	100.01	75.01	48.60	48.60	48.60	38.91	0.00	0.00	0.00	0.00	0.00	0.00
5	Pipeline damage repair	0.00	0.00	13.90	20.24	10.97	8.78	8.78	8.78	6.58	0.00	0.00	0.00	0.00	0.00	0.00
6	Port damage repair	0.00	0.00	13.68	8.70	4.59	5.26	5.26	4.97	2.77	0.00	0.00	0.00	0.00	0.00	0.00
7	Army Airfield damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Troop camp construction	0.00	0.00	7.24	12.51	15.15	16.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Admin space construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.54	11.62	11.01	10.53	10.05
10	Gen supply storage construction	0.00	0.00	0.00	0.00	2.72	15.07	31.81	42.49	50.86	63.21	0.00	0.00	0.00	0.00	0.00
11	Ammunition storage construction	0.00	37.95	108.45	209.83	199.25	250.25	312.10	329.06	343.93	0.00	0.00	0.00	0.00	0.00	0.00
12	Refrigerated storage construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	POL storage construction	0.00	143.03	65.03	8.82	8.42	7.13	7.33	6.49	5.40	0.00	0.00	0.00	0.00	0.00	0.00
14	EPW camp construction	0.00	0.00	0.00	0.08	0.22	0.31	0.37	0.49	0.59	0.00	0.00	0.00	0.00	0.00	0.00
15	ADA site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	DEPMEDs site preparation	0.00	0.00	0.00	0.00	0.00	0.00	13.36	7.96	4.70	0.00	0.00	0.00	0.00	0.00	0.00
17	Dispensary/dental clinic construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Maintenance facility construction	0.00	0.21	7.07	12.36	10.79	9.07	14.21	8.79	4.93	0.00	0.00	0.00	0.00	0.00	0.00
19	Replacement camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Road hardstand construction	0.00	8.13	4.58	3.68	5.52	3.86	3.83	2.68	3.66	2.97	0.00	0.00	0.00	0.00	0.00
21	Road maintenance	0.34	2.59	1.78	1.67	1.52	1.52	1.48	1.48	1.74	0.00	0.00	0.00	0.00	0.00	0.00
22	Railroad maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	Port maintenance	0.00	8.03	7.94	8.42	6.60	6.79	7.65	7.27	7.94	8.51	22.47	10.23	7.84	9.95	5.45
	TOTAL PER DAY	0.34	199.95	1000.20	838.10	672.58	663.97	733.68	747.94	799.97	74.69	48.01	21.85	18.86	20.48	15.50

		CLASS IV STON PER DAY DURING TIME PERIOD														
	TASK DESCRIPTION	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Road damage repair	0.00	0.00	3.82	3.54	3.02	2.81	2.90	2.90	3.42	0.00	0.00	0.00	0.00	0.00	0.00
2	Highway bridge damage repair	0.00	0.00	616.71	448.26	328.82	287.89	276.00	276.00	324.53	0.00	0.00	0.00	0.00	0.00	0.00
3	Railroad damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Railroad bridge damage repair	0.00	0.00	150.02	100.01	75.01	48.60	48.60	48.60	38.91	0.00	0.00	0.00	0.00	0.00	0.00
5	Pipeline damage repair	0.00	0.00	13.90	20.24	10.97	8.78	8.78	8.78	6.58	0.00	0.00	0.00	0.00	0.00	0.00
6	Port damage repair	0.00	0.00	13.68	8.70	4.59	5.26	5.26	4.97	2.77	0.00	0.00	0.00	0.00	0.00	0.00
7	Army Airfield damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Troop camp construction	0.00	0.00	7.24	12.51	15.15	16.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Admin space construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.54	11.62	11.01	10.53	10.05
10	Gen supply storage construction	0.00	0.00	0.00	0.00	0.94	5.20	10.98	14.66	17.55	21.81	0.00	0.00	0.00	0.00	0.00
11	Ammunition storage construction	0.00	37.95	108.45	209.83	199.25	250.25	312.10	329.06	343.93	0.00	0.00	0.00	0.00	0.00	0.00
12	Refrigerated storage construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	POL storage construction	0.00	147.06	66.86	9.06	8.66	7.33	7.54	6.67	5.55	0.00	0.00	0.00	0.00	0.00	0.00
14	EPW camp construction	0.00	0.00	0.00	0.08	0.22	0.31	0.37	0.49	0.59	0.00	0.00	0.00	0.00	0.00	0.00
15	ADA site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	DEPMEDs site preparation	0.00	0.00	0.00	0.00	0.00	0.00	13.36	7.96	4.70	0.00	0.00	0.00	0.00	0.00	0.00
17	Dispensary/dental clinic construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Maintenance facility construction	0.00	0.41	13.40	23.42	20.45	17.20	26.94	16.65	9.34	0.00	0.00	0.00	0.00	0.00	0.00
19	Replacement camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Road hardstand construction	0.00	8.13	4.58	3.68	5.52	3.86	3.83	2.68	3.66	2.97	0.00	0.00	0.00	0.00	0.00
21	Road maintenance	0.34	2.59	1.78	1.67	1.52	1.52	1.48	1.48	1.74	0.00	0.00	0.00	0.00	0.00	0.00
22	Railroad maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	Port maintenance	0.00	8.03	7.94	8.42	6.60	6.79	7.65	7.27	7.94	8.51	22.47	10.23	7.84	9.95	5.45
	Airfields	0.00	801.19	801.19	801.19	801.19	801.19	801.19	801.19	801.19	801.19	801.19	801.19	801.19	801.19	801.19
	TOTAL PER DAY	0.34	1005.37	1809.56	1650.60	1481.88	1463.61	1526.97	1529.36	1572.41	834.48	849.20	823.04	820.04	821.66	816.68

COMMZ Base Development Class IV Consumption - MRCE

Adjusted to Include Airfields and Recommended Changes in Facilities

APPENDIX C: Adjusted Manhour and Material Requirement for AFCS Facilities Used in FASTALS

The list of AFCS facilities used to determine the FASTALS engineer workloads was reviewed by the 412th and 416th ENCOMs. At their suggestion, several facilities were changed from the original list to reflect current construction standards. The changes affected POL storage, primarily by replacing the original tanks with collapsible tanks of the same size. The changes also affected general supply storage, clinics, and maintenance facilities by replacing the original buildings with K-Span structures. The table on the following three pages indicates by shading the changes made in the original list (Appendix A).

Manhour and Material Requirements for AFCS Facilities Used for FASTALS

Adjusted at Shaded Areas to Reflect Current Practice and to Include Airfield Tasks

TASK	FACILITY DESCRIPTION	FACILITY NO	HORIZONTAL MANHOURS	VERTICAL MANHOURS	GENERAL MANHOURS	TOTAL STON	CLASS II STON	CLASS IV STON	CLASS VII STON	CLASS IX STON	LOCAL CU YD
1	Crater repair	11100CE	13.00	0.00	18.00	0.00	0.00	0.00	0.00	0.00	14
1	Culvert--Europe	85290AM	32.00	0.00	144.00	6.15	0.00	6.15	0.00	0.00	27
1	Culvert--SWA & NEA	85290AV	60.00	0.00	270.00	12.33	0.00	12.33	0.00	0.00	54
1	Road surface 1 mile	85110BN	241.00	0.00	68.00	0.00	0.00	0.00	0.00	0.00	2737
2	80-ft Bailey bridges (2)	85120HE	110.00	0.00	127.00	4.07	0.00	0.07	4.00	0.00	0
2	Pier (1)	85120EC	50.00	101.00	105.00	31.92	0.14	26.45	0.00	5.33	0
3	Railroad repair 1 mile	86010YA	1818.00	0.00	4752.00	0.00	0.00	0.00	0.00	0.00	0
4	Span (40 ft) and pier	86030TP	130.00	588.00	432.00	26.73	0.00	25.31	0.00	1.42	0
5	6 in aluminum pipe 200 ft	12520AD	4.00	28.00	32.00	1.06	0.00	1.06	0.00	0.00	0
5	Bolted steel pipe 200 ft	12510YA	20.00	48.00	48.00	1.69	0.12	0.00	0.00	1.57	0
5	6 or 8 in pump station	12530BB	11.00	80.00	60.00	14.99	0.12	11.70	3.09	0.08	0
5	500 ft critical gap crossing	12592HH	24.00	72.00	96.00	5.60	0.00	5.60	0.00	0.00	0
6	Port damage repair	15250AU	390.00	1020.00	1020.00	29.24	0.03	29.05	0.00	0.17	0
7	50000 gal refuel system	12110AN	60.00	0.00	0.00	8.22	0.02	3.37	1.04	3.79	0
7	Runway Lighting 8000 ft	13610AA	0.00	84.00	60.00	22.04	0.00	22.04	0.00	0.00	0
7	Flight control tower	13315BA	1.00	487.00	97.00	14.57	0.05	13.82	0.00	0.71	5
7	Crater repairs (3)	11150AF	90.00	12.00	144.00	57.58	0.00	30.54	27.04	0.00	288
8	Cesspool	83190AA	11.00	100.00	156.00	4.30	0.00	4.14	0.00	0.16	46
8	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
8	Road preparation 1 mile Europe	85130FA	2086.00	0.00	830.00	14.32	0.00	13.80	0.00	0.53	0
8	Road preparation 1 mile SWA & NEA	85130FW	6850.00	0.00	2719.00	27.48	0.00	23.79	0.00	3.69	0
8	Road surface 1 mile	85110BM	189.00	0.00	64.00	0.00	0.00	0.00	0.00	0.00	1807
8	Hardstand prep 1000 sy Europe	85210AU	203.00	0.00	73.00	0.00	0.00	0.00	0.00	0.00	0
8	Hardstand prep 1000 sy SWA & NEA	85210BR	594.00	0.00	184.00	18.61	0.00	18.61	0.00	0.00	0
8	Hardstand surface 1000 sy	85110DF	24.00	0.00	8.00	0.00	0.00	0.00	0.00	0.00	111
9	Hardstand 1000 sy Europe & NEA	85210BC	297.00	0.00	119.00	7.15	0.00	7.15	0.00	0.00	0
9	Road hardstand 1000 sy SWA	85210AH	198.00	0.00	68.00	2.72	0.00	2.72	0.00	0.00	0
9	Latrine	72321CB	0.00	2.00	2.00	0.12	0.00	0.12	0.00	0.00	0
9	40 ft X 100 ft general admin bldg	61050JN	64.00	449.00	244.00	16.97	0.91	13.05	1.24	1.77	58
9	40 ft X 50 ft general admin bldg	61050HN	29.00	153.00	77.00	9.27	0.46	7.20	0.69	0.93	30
9	Electrical distribution 25000 sf	81240BL	48.00	474.00	98.00	2.71	0.03	2.34	0.00	0.34	0
9	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
10	BUILDING,RELMS,40X100X16	93170AP	46.00	741.00	555.00	13.00	0.00	12.89	0.00	0.11	18
10	BUILDING,RELMS,60X200X24	93170BG	121.00	2182.00	1506.00	38.52	0.00	38.35	0.00	0.17	34
10	Latrine	72321DB	8.00	58.00	20.00	1.83	0.00	1.73	0.00	0.10	0
10	Fire protection sump 10000 gal	84330AC	16.00	108.00	116.00	2.87	0.00	2.87	0.00	0.00	14
10	Road	85110AT	274.00	0.00	76.00	0.00	0.00	0.00	0.00	0.00	3129
10	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
11	Hardstand 1000 sy Europe	85210AY	215.00	0.00	77.00	7.15	0.00	7.15	0.00	0.00	0
11	Hardstand prep 1000 sy SWA & NEA	85210BR	594.00	0.00	184.00	18.61	0.00	18.61	0.00	0.00	0
11	1-lane road prep 1 mile Europe	85130KH	1752.00	0.00	639.00	11.61	0.00	11.18	0.00	0.43	0
11	1-lane road prep 1 mile SWA & NEA	85130LC	4840.00	0.00	1887.00	22.16	0.00	19.19	0.00	2.98	0
11	2-lane road prep 1 mile Europe	85130FD	2265.00	0.00	905.00	14.32	0.00	13.80	0.00	0.53	0

TASK	FACILITY DESCRIPTION	FACILITY NO	HORIZONTAL MANHOURS	VERTICAL MANHOURS	GENERAL MANHOURS	TOTAL STON	CLASS II STON	CLASS IV STON	CLASS VII STON	CLASS IX STON	LOCAL CU YD
11	2-lane road prep 1 mile SWA & NEA	85130FW	6850.00	0.00	2719.00	27.48	0.00	23.79	0.00	3.69	0
11	Road surface 1 mile	85110BN	241.00	0.00	68.00	0.00	0.00	0.00	0.00	0.00	2737
11	2-lane road paving 1 mile	85110AT	274.00	0.00	76.00	0.00	0.00	0.00	0.00	0.00	3129
12	Cold storage hardstand 4000 cf	43191YB	183.00	0.00	68.00	0.00	0.00	0.00	0.00	0.00	56
13	TPT TANK FARM MODULE, 10MBBL CAP	12665BB	140.00	850.00	430.00	4.80	0.01	2.75	2.00	0.04	0
13	3 FUEL/WATER STOR 50,000 GAL FAB B	41180BD	90.00	310.00	220.00	2.21	0.00	0.00	2.15	0.06	0
13	FUEL/WATER STOR 50,000 GAL FAB BA	41180BD	80.00	320.00	130.00	0.74	0.00	0.00	0.72	0.02	0
13	FUEL/WATER STOR 10,000 GAL FAB BA	41180BC	25.00	100.00	45.00	0.18	0.00	0.00	0.15	0.02	0
13	TPT TANK FARM MODULE, 10MBBL CAP	12665BB	140.00	850.00	420.00	4.80	0.01	2.75	2.00	0.04	0
13	3 FUEL/WATER STOR 50,000 GAL FAB B	41180BD	90.00	310.00	210.00	2.21	0.00	0.00	2.15	0.06	0
13	Tank pump (2800 BPH)	12530AK	5.00	40.00	15.00	0.95	0.27	0.01	0.00	0.68	0
13	Switch manifold (6 in w/o pump)	12510AB	10.00	150.00	50.00	9.10	3.65	2.34	0.00	3.11	0
13	6IN-SWITCH MNFLD F/TNK FARM W/O P	12510AB	10.00	180.00	60.00	9.10	3.65	2.34	0.00	3.11	0
13	TANK PMP POL 700 BPH W/6 IN MANIFD	12510AH	5.00	35.00	10.00	3.84	0.14	1.03	2.30	0.36	0
13	TRANS PMP POL 700 BPH W/6 IN MNF	12510AN	35.00	245.00	50.00	11.18	4.87	1.36	2.30	2.65	0
13	P/L SET 6IN ALUM W/CLMP COUP 1000F	12510DG	10.00	200.00	140.00	3.59	0.00	3.59	0.00	0.00	0
13	P/L SET 6IN ALUM W/CLMP COUP 1000F	12510DG	10.00	110.00	60.00	3.59	0.00	3.59	0.00	0.00	0
13	Flood pump (785 BPH w/8 in dia)	12510AE	10.00	215.00	55.00	10.25	1.68	1.77	4.60	2.21	0
13	Lightweight tubing (1000 ft w/6 in dia)	12510AU	10.00	75.00	45.00	6.15	4.43	0.00	0.00	1.72	0
13	FLOOD PMP 785 BPH 6IN MANIFOLD	12510AE	20.00	280.00	80.00	10.25	1.68	1.77	4.60	2.21	0
13	API pipe (1000 ft w/6 in diameter)	12510BJ	5.00	115.00	70.00	11.19	0.00	0.00	0.00	11.19	0
13	Tank pump (700 BPH w/6 in dia)	12510AH	5.00	35.00	10.00	3.84	0.14	1.03	2.30	0.36	0
13	Transfer pump (700 BPH w/6 in dia)	12510AN	30.00	230.00	50.00	11.18	4.87	1.36	2.30	2.65	0
13	Hardstand (350 sy) and facility (800 sf)	61050YA	128.00	0.00	48.00	0.00	0.00	0.00	0.00	0.00	45
13	Security fence	87210AR	48.00	222.00	224.00	4.14	0.00	4.14	0.00	0.00	0
13	Security gate	87210AT	8.00	120.00	48.00	0.61	0.00	0.59	0.00	0.02	251
13	Fuel sys sup pt (120000 gal)	12640BA	62.00	82.00	68.00	16.28	0.03	3.07	5.37	7.81	0
14	Guard tower	87220AA	7.00	72.00	44.00	2.81	0.00	2.78	0.00	0.03	0
14	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
14	1000 sy hardstand	85210AG	63.00	0.00	20.00	2.72	0.00	2.72	0.00	0.00	0
14	Road 1 mile	85130JR	666.00	0.00	209.00	6.02	0.00	5.08	0.00	0.94	0
14	1000 ft fence	87210CE	16.00	98.00	340.00	7.27	0.00	7.27	0.00	0.00	5
14	1000 ft barbed tape	87210AD	28.00	0.00	112.00	1.85	0.00	1.85	0.00	0.00	0
14	Personnel gate	87210CR	6.00	0.00	6.00	0.17	0.00	0.16	0.00	0.01	0
14	Vehicle gate	87210CF	15.00	0.00	15.00	0.41	0.00	0.27	0.00	0.15	0
14	Electrical distribution	81240CG	150.00	370.00	220.00	20.94	0.66	9.86	4.76	5.45	0
14	Personnel light	81230AH	0.00	12.00	0.00	0.06	0.02	0.00	0.00	0.03	0
15	Concertina wire 300 ft	87210AY	1.00	106.00	2.00	1.03	0.00	1.03	0.00	0.00	0
15	Electrical distribution 1 mile	81240GB	125.00	1035.00	640.00	18.66	0.09	16.64	0.00	1.93	0
15	Latrine	72321CB	0.00	2.00	2.00	0.12	0.00	0.12	0.00	0.00	0
15	Road 1 mile	85130GP	730.00	0.00	247.00	1.11	0.00	0.69	0.00	0.43	0
15	Earthen revetment	14910GA	67.00	0.00	17.00	0.52	0.00	0.52	0.00	0.00	0
15	Hardstand 1000 sy	61050YA	128.00	0.00	48.00	0.00	0.00	0.00	0.00	0.00	45

Manhour and Material Requirements for AFCS Facilities Used for FASTALS

Adjusted at Shaded Areas to Reflect Current Practice and to Include Airfield Tasks

Manhour and Material Requirements for AFCS Facilities Used for FASTALS

Adjusted at Shaded Areas to Reflect Current Practice and to Include Airfield Tasks

TASK	FACILITY DESCRIPTION	FACILITY NO	HORIZONTAL MANHOURS	VERTICAL MANHOURS	GENERAL MANHOURS	TOTAL STON	CLASS II STON	CLASS IV STON	CLASS VII STON	CLASS IX STON	LOCAL CU YD
15	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
16	Latrine	72321CB	0.00	2.00	2.00	0.12	0.00	0.12	0.00	0.00	0
16	Hardstand 1000 sy	85210BF	327.00	0.00	118.00	11.01	0.00	11.01	0.00	0.00	0
16	Class B road 1 mile	85130FK	3347.00	0.00	1477.00	20.51	0.00	16.82	0.00	3.69	0
16	Fire protection sump 10000 gal	84330AC	16.00	108.00	116.00	2.87	0.00	2.87	0.00	0.00	14
16	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
16	Electrical distribution 500 bed	81240BA	365.00	5430.00	1685.00	21.62	0.66	18.06	0.00	2.90	0
16	Water distribution 500 bed	84210AU	200.00	900.00	900.00	4.49	0.00	2.47	0.00	2.02	11
17	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
17	10-bed dispensary	93170AJ	44.00	150.00	80.00	9.42	0.00	9.32	0.00	0.10	17
17	1300 sy hardstand	55020YC	476.00	0.00	177.00	14.31	0.00	14.31	0.00	0.00	145
17	Latrine	72321CB	0.00	2.00	2.00	0.12	0.00	0.12	0.00	0.00	0
17	BUILDING,RELMS,30X100X15	93170AJ	110.00	369.00	116.00	9.42	0.00	9.32	0.00	0.10	17
17	110 sy hardstand	54010YA	403.00	0.00	150.00	12.11	0.00	12.11	0.00	0.00	122
18	60 ft X 60 ft maintenance interior	21410AD	0.00	133.00	81.00	1.07	0.00	0.60	0.00	0.46	0
18	BUILDING,RELMS,60X60X24	93170AY	198.00	980.00	188.00	14.85	0.00	14.78	0.00	0.07	18
18	1000 sf concrete floor	93191GG	1.94	46.11	16.11	4.53	0.02	4.24	0.00	0.27	20
18	60 ft X 80 ft maintenance interior	21410AH	0.00	150.00	95.00	1.44	0.00	0.86	0.00	0.58	0
18	BUILDING,RELMS,60X80X18	93170BA	240.00	1260.00	280.00	18.34	0.00	18.26	0.00	0.09	22
19	Cesspool	83190AA	11	100	156	4.30	0.00	4.14	0.00	0.16	46
19	Site preparation 1 acre	87190AA	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0
19	Road prep 1 mile Europe	85130FA	2086.00	0.00	830.00	14.32	0.00	13.80	0.00	0.53	0
19	Road prep 1 mile SWA & NEA	85130FW	6850.00	0.00	2719.00	27.48	0.00	23.79	0.00	3.69	0
19	Road surface 1 mile	85110BM	189.00	0.00	64.00	0.00	0.00	0.00	0.00	0.00	1807
19	Hardstand prep 1000 sy Europe	85210AU	203.00	0.00	73.00	0.00	0.00	0.00	0.00	0.00	0
19	Hardstand prep 1000 sy SWA & NEA	85210BR	594.00	0.00	184.00	18.61	0.00	18.61	0.00	0.00	0
19	Hardstand surface 1000 sy	85110DF	24.00	0.00	8.00	0.00	0.00	0.00	0.00	0.00	111
20	Road hardstand 1000 sy Europe	85210BC	297.00	0.00	119.00	7.15	0.00	7.15	0.00	0.00	0
20	Road hardstand 1000 sy SWA & NEA	85210AH	172.00	0.00	59.00	2.72	0.00	2.72	0.00	0.00	0
21	Road maintenance 100 miles for 30 days	85140AE	3600.00	0.00	4800.00	4.87	0.00	4.87	0.00	0.00	0
22	Railroad maint 1 mile per day Eur & NEA		1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0
22	Railroad maint 1 mile per day SWA		1.25	1.25	1.25	0.00	0.00	0.00	0.00	0.00	0
23	Port maintenance		39.00	102.00	102.00	2.92	0.00	2.91	0.00	0.02	0
24	FIXED-WING AC PARK APR W/TAXILANE	11310CE	606.0	0.0	1818.0	1424.89	0.00	1423.86	1.03	0.00	18324
24	REVETMENT,PREFAB,SELF-SUPPORTIN	14902FB	202.0	3.0	1.0	59.00	0.00	59.00	0.00	0.00	0
24	SITE PREPARATION,ONE ACRE	87190AA	18.9	0.0	36.0	0.00	0.00	0.00	0.00	0.00	0
24	BUILDING,RELMS,40X120X20 ALL CLIMA	93170AU	0.0	144.0	0.0	16.78	0.00	16.66	0.00	0.12	20
24	RUNWAY W/40 FT SHOULDERS, 1000 X	11110BA	319.9	0	2453.4	424.51	0	366.85	57.66	0	0

APPENDIX D: Corps-Area Base Development Class IV Consumption for the TAA-2001 Scenarios

While the FASTALS construction model only calculates the requirements for engineer combat heavy battalions behind the corps rear area, the output tables contain enough information to extend the calculation to the base development tasks performed with corps assets in the forward regions. This work is primarily MSR maintenance and repair, construction of supply storage facilities and EPW camps, and site preparation for DEPMEDS. The facilities used for the work behind the corps rear area were of such an austere nature that they were deemed suitable for corps area work as well. The corresponding FASTALS task workloads and accumulated facilities were identified by region, and the forwardmost region for engineer work was examined to ensure no duplication of effort. The tables on the following pages indicate the Class IV requirements associated with the resulting corps-area engineer workload.

Corps-Area Base Development Class IV Consumption - Europe

		CLASS IV STON PER DAY DURING TIME PERIOD							
	TASK DESCRIPTION	2	3	4	5	6	7	8	9
1	Road damage repair	0.00	0.00	0.02	0.04	0.03	0.06	0.03	0.05
2	Highway bridge damage repair	0.00	0.00	5.10	7.80	4.14	8.27	1.88	1.40
3	Railroad damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Railroad bridge damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Pipeline damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Port damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Army Airfield damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Troop camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Admin space construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Gen supply storage construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	Ammunition storage construction	0.00	0.00	9.14	9.14	9.14	8.97	6.02	3.18
12	Refrigerated storage construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	POL storage construction	0.00	28.65	122.15	109.61	84.11	78.68	34.22	25.06
14	EPW camp construction	0.00	1.62	0.39	0.48	0.95	1.22	1.06	1.21
15	ADA site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	DEPMEDs site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	Dispensary/dental clinic construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Maintenance facility construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	Replacement camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Road hardstand construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	Road maintenance	0.05	0.03	0.02	0.03	0.03	0.05	0.03	0.04
22	Railroad maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	Port maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Airfields	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TOTAL PER DAY	0.05	30.30	136.82	127.10	98.40	97.25	43.24	30.94

		CLASS IV STON PER DAY DURING TIME PERIOD																
	TASK DESCRIPTION	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Road damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
2	Highway bridge damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.04	0.04	0.09	0.09	0.10	0.10	0.20	0.10	0.10
3	Railroad damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Railroad bridge damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Pipeline damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Port damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Army Airfield damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Troop camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Admin space construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Gen supply storage construction	0.00	0.00	2.68	1.79	0.89	1.00	1.06	1.23	7.31	7.58	12.63	5.62	21.32	33.25	10.24	5.36	5.36
11	Ammunition storage construction	0.00	0.00	1.34	0.90	0.45	0.94	0.89	0.89	0.89	0.89	4.44	7.80	6.18	21.88	13.30	4.08	4.08
12	Refrigerated storage construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	POL storage construction	0.00	0.00	0.12	0.10	0.05	0.03	0.02	0.02	0.02	0.13	0.18	0.19	0.26	0.97	0.50	0.07	0.07
14	EPW camp construction	0.10	0.20	0.18	0.21	0.27	0.50	0.42	0.00	0.02	0.00	0.46	0.20	0.09	0.00	0.00	0.00	0.00
15	ADA site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	DEPMEDs site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	Dispensary/dental clinic construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Maintenance facility construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	Replacement camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Road hardstand construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	Road maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	Railroad maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	Port maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Airfields	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TOTAL PER DAY	**0.10**	**0.20**	**4.33**	**2.99**	**1.67**	**2.48**	**2.47**	**2.22**	**8.28**	**8.64**	**17.81**	**13.91**	**27.95**	**56.20**	**24.25**	**9.63**	**9.63**

Corps-Area Base Development Class IV Consumption - MRCW

Corps-Area Base Development Class IV Consumption - MRCE

		CLASS IV STON PER DAY DURING TIME PERIOD														
	TASK DESCRIPTION	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Road damage repair	0.00	0.00	0.00	0.23	0.12	0.11	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Highway bridge damage repair	0.00	0.00	0.00	26.49	11.45	10.02	8.59	8.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Railroad damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Railroad bridge damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Pipeline damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Port damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Army Airfield damage repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Troop camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Admin space construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Gen supply storage construction	0.00	0.21	0.50	0.84	0.61	0.20	1.22	1.98	2.19	4.96	0.00	0.00	0.00	0.00	0.00
11	Ammunition storage construction	0.00	2.68	3.76	6.97	7.36	1.10	1.16	11.15	9.05	0.00	0.00	0.00	0.00	0.00	0.00
12	Refrigerated storage construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	POL storage construction	0.00	1.63	2.58	4.00	2.96	0.00	1.28	0.26	0.41	0.00	0.00	0.00	0.00	0.00	0.00
14	EPW camp construction	0.00	0.05	0.13	0.19	0.21	0.21	0.10	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00
15	ADA site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	DEPMEDs site preparation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	Dispensary/dental clinic construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Maintenance facility construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	Replacement camp construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Road hardstand construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	Road maintenance	0.03	0.00	0.00	0.11	0.06	0.06	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	Railroad maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	Port maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Airfields	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TOTAL PER DAY	**0.03**	**4.56**	**6.96**	**38.84**	**22.77**	**11.69**	**12.50**	**22.19**	**11.68**	**4.96**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

APPENDIX E: Barrier/Fortification/ Construction Requirements by Unit Type

The tables in this appendix provide the foundation for the calculation of a divisional Class IV requirement and a nondivisional unit Class IV requirement above the base development tasks. This data was used for the calculations described in Chapter 3 involving the TAA scenarios and for the C4 model described in Chapter 5. These tables focus primarily on unit barrier and fortification requirements but also include heliports and field latrines as other Class IV consumers at the unit level. The unit structures for each division, armored cavalry regiment, and separate brigade were provided by ODCSOPS. The number of each type of emplacement required by each type of unit was determined by the U.S. Army Engineer School and reviewed and refined by corps-level planners at I Corps, III Corps, and XVIII Airborne Corps.

Unit Barrier/Fortification/Construction Requirements - Armor Division

UNIT STRUCTURE					EMPLACEMENTS FOR EACH UNIT OF THE GIVEN TYPE FOR A SINGLE LOCATION											
TYPE OF UNIT	SRC	UNIT STRENGTH	NUMBER OF UNITS	TOTAL STRENGTH	TRIPLE STANDARD CONCERTINA	FOUR STRAND FENCE	COMMAND POST	2-MAN POSITION W/OVERHEAD	FIGHTING BUNKER	PERIMETER BUNKER/TOWER	MORTAR POSITION WITH OVERHEAD	OBSTACLE MATERIALS	FIELD ARTILLERY REVETMENT	AIR DEFENSE REVETMENT	HELIPORT	LATRINE
HHC AVN BDE	01302A000	90	1	90	1	0	2	25	0	0	0	0	0	0	0	1
GS AVN BN	01305A000	327	1	327	6	6	6	44	6	0	0	0	0	0	1	3
ATK HEL BN	01385A200	302	2	604	6	6	6	31	6	0	0	0	0	0	1	3
HHC ENGR BDE	05332L000	55	1	55	1	0	2	8	0	0	0	0	0	0	0	1
EN BN	05335L000	433	3	1299	6	0	6	137	2	0	0	3	0	0	0	4
HHB DIVARTY	06302L000	185	1	185	2	0	2	73	0	0	0	0	0	0	0	2
TGT ACQ BTRY	06303L000	79	1	79	1	0	1	30	0	0	0	0	5	0	0	1
155P SP BN 3X8-2X1	06365L400	735	1	735	3	0	3	27	0	0	0	0	24	0	0	6
155S SP BN 3X8-1X2	06365L500	760	2	1520	3	0	3	27	0	0	0	0	24	0	0	7
MLRS BTRY	06398L000	127	1	127	1	0	1	54	0	0	0	0	9	0	0	2
IN BN MECH (BFVS)	07245L000	827	4	3308	14	0	2	49	0	0	5	0	0	0	0	7
6 NODE DIV SIG BN (MSE)	11065L400	683	1	683	6	6	6	222	6	0	0	0	0	0	0	6
AG BAND	12113L000	41	1	41	1	0	1	11	0	0	0	0	0	0	0	1
AR BN (M1A2)	17378L000	584	5	2920	11	0	2	37	0	0	6	0	0	0	0	5
AR CAV SQD (M1A2/M3)	17263L100	673	1	673	11	0	2	65	0	0	5	0	0	0	0	6
AD BN FAADS HVY	44175L300	658	1	658	2	0	2	309	0	0	0	0	0	24	0	6
AVN SPT BN	63825L200	450	1	450	2	2	2	205	0	0	0	0	0	0	0	4
HHC DIV	87004L200	284	1	284	1	0	4	102	0	0	0	0	0	0	0	3
HHC BDE	87042L200	86	3	258	3	0	3	13	0	0	0	0	0	0	0	1
DIV REAR CP OPNS	87103L000	19	1	19	1	0	2	0	0	0	0	0	0	0	0	1
CM CO	03157L200	171	1	171	1	0	1	66	1	0	0	0	0	0	0	2
MP CO	19333L000	153	1	153	1	0	1	57	1	0	0	0	0	0	0	2
MI BN CEWI	34285L000	410	1	410	3	3	4	155	1	0	0	0	0	0	0	4
HHC DISCOM	63002L000	222	1	222	2	0	2	71	2	0	0	0	0	0	0	2
FWD SPT BN (2X1)	63005L100	447	2	894	36	36	0	194	3	16	0	0	0	0	0	4
FWD SPT BN (1X2)	63005L300	439	1	439	36	36	0	190	3	16	0	0	0	0	0	4
MAIN SUPPORT BN	63135L000	1030	1	1030	36	36	2	465	3	16	0	0	0	0	0	9
DIVISION TOTALS				17634	346	173	109	3514	47	64	55	9	86	24	3	162

UNIT STRUCTURE					EMPLACEMENTS FOR EACH UNIT OF THE GIVEN TYPE FOR A SINGLE LOCATION											
TYPE OF UNIT	SRC	UNIT STRENGTH	NUMBER OF UNITS	TOTAL STRENGTH	TRIPLE STANDARD CONCERTINA	FOUR STRAND FENCE	COMMAND POST	2-MAN POSITION W/OVERHEAD	FIGHTING BUNKER	PERIMETER BUNKER/TOWER	MORTAR POSITION WITH OVERHEAD	OBSTACLE MATERIALS	FIELD ARTILLERY REVETMENT	AIR DEFENSE REVETMENT	HELIPORT	LATRINE
HHC AVN BDE	01302A000	90	1	90	1	0	2	25	0	0	0	0	0	0	0	1
GS AVN BN	01305A000	327	1	327	6	6	6	44	6	0	0	0	0	0	1	3
ATK HEL BN	01385A200	302	2	604	6	6	6	31	6	0	0	0	0	0	1	3
HHC ENGR BDE	05332L000	55	1	55	1	0	2	8	0	0	0	0	0	0	0	1
EN BN	05335L000	433	3	1299	6	0	6	137	2	0	0	3	0	0	0	4
HHB DIVARTY	06302L000	185	1	185	2	0	2	73	0	0	0	0	0	0	0	2
TGT ACQ BTRY	06303L000	79	1	79	1	0	1	30	0	0	0	0	5	0	0	1
155P SP BN 3X8-2X1	06365L400	735	1	735	3	0	3	27	0	0	0	0	24	0	0	6
155S SP BN 3X8-1X2	06365L500	760	2	1520	3	0	3	27	0	0	0	0	24	0	0	7
MLRS BTRY	06398L000	127	1	127	1	0	1	54	0	0	0	0	9	0	0	2
IN BN MECH (BFVS)	07245L000	827	5	4135	14	0	2	49	0	0	5	0	0	0	0	7
6 NODE DIV SIG BN (MSE)	11065L400	683	1	683	6	6	6	222	6	0	0	0	0	0	0	6
AG BAND	12113L000	41	1	41	1	0	1	11	0	0	0	0	0	0	0	1
AR BN (M1A2)	17378L000	584	4	2336	11	0	2	37	0	0	6	0	0	0	0	5
AR CAV SQD (M1A2/M3)	17263L100	673	1	673	11	0	2	65	0	0	5	0	0	0	0	6
AD BN FAADS HVY	44175L300	658	1	658	2	0	2	309	0	0	0	0	0	24	0	6
AVN SPT BN	63825L200	450	1	450	2	2	2	205	0	0	0	0	0	0	0	4
HHC DIV	87004L200	284	1	284	1	0	4	102	0	0	0	0	0	0	0	3
HHC BDE	87042L200	86	3	258	3	0	3	13	0	0	0	0	0	0	0	1
DIV REAR CP OPNS	87103L000	19	1	19	1	0	2	0	0	0	0	0	0	0	0	1
CM CO	03157L200	171	1	171	1	0	1	66	1	0	0	0	0	0	0	2
MP CO	19333L000	153	1	153	1	0	1	57	1	0	0	0	0	0	0	2
MI BN CEWI	34285L000	410	1	410	3	3	4	155	1	0	0	0	0	0	0	4
HHC DISCOM	63002L000	222	1	222	2	0	2	71	2	0	0	0	0	0	0	2
FWD SPT BN (2X1)	63005L100	447	2	894	36	36	0	194	3	16	0	0	0	0	0	4
FWD SPT BN (1X2)	63005L300	439	1	439	36	36	0	190	3	16	0	0	0	0	0	4
MAIN SUPPORT BN	63135L000	1030	1	1030	36	36	2	465	3	16	0	0	0	0	0	9
DIVISION TOTALS				17877	349	173	109	3526	47	64	54	9	86	24	3	164

Unit Barrier/Fortification/Construction Requirements - Mechanized Division

Unit Barrier/Fortification/Construction Requirements - Infantry Division (Light)

UNIT STRUCTURE					EMPLACEMENTS FOR EACH UNIT OF THE GIVEN TYPE FOR A SINGLE LOCATION											
TYPE OF UNIT	SRC	UNIT STRENGTH	NUMBER OF UNITS	TOTAL STRENGTH	TRIPLE STANDARD CONCERTINA	FOUR STRAND FENCE	COMMAND POST	2-MAN POSITION W/OVERHEAD	FIGHTING BUNKER	PERIMETER BUNKER/TOWER	MORTAR POSITION WITH OVERHEAD	OBSTACLE MATERIALS	FIELD ARTILLERY REVETMENT	AIR DEFENSE REVETMENT	HELIPORT	LATRINE
HHC AVN BDE	01102A000	179	1	179	1	0	2	70	0	0	0	0	0	0	0	2
ASLT HEL BN (LT)	01105A000	351	1	351	6	6	6	56	6	0	0	0	0	0	1	3
ATK HEL BN	01185A200	242	1	242	6	6	6	11	5	0	0	0	0	0	1	2
EN BN (LID)	05185L000	400	1	400	6	0	6	120	2	0	0	3	0	0	0	4
HHB DIVARTY (LID)	06102L000	110	1	110	2	0	2	35	0	0	0	0	0	0	0	1
105 T BN 3X6 (LID)	06125L000	414	3	1242	3	0	3	177	0	0	0	0	18	0	0	4
155T BTRY 1X3	06107L000	142	1	142	3	0	3	41	0	0	0	0	8	0	0	2
IN BN LT	07015L000	569	9	5121	13	0	5	195	4	0	13	0	0	0	0	5
DIV SIG BN (MSE)	11065L200	564	1	564	6	6	6	162	6	0	0	0	0	0	0	5
AG BAND	12113L000	41	1	41	1	0	1	11	0	0	0	0	0	0	0	1
AR RECON SQ	17185L000	261	1	261	11	0	2	37	0	0	0	0	0	0	1	3
MP CO	19323L000	81	1	81	1	0	1	21	1	0	0	0	0	0	0	1
MI BN CEWI	34295L000	487	1	487	3	3	4	194	1	0	0	0	0	0	0	4
AD BN FAADS LID	44115L300	333	1	333	2	0	2	147	0	0	0	0	0	36	0	3
HHC DISCOM	63222L000	147	1	147	2	0	2	34	2	0	0	0	0	0	0	2
FWD SPT BN, LID	63215L000	192	3	576	36	36	0	66	3	16	0	0	0	0	0	2
MAIN SPT BN, LID	63225L000	416	1	416	36	36	2	158	3	16	0	0	0	0	0	4
AVN MAINT CO	01977A000	293	1	293	2	2	2	97	3	0	0	0	0	0	0	3
HHC DIV (LID)	77004L000	230	1	230	1	0	4	75	0	0	0	0	0	0	0	2
HHC BDE (LID)	77042L000	123	3	369	3	0	3	32	0	0	0	0	0	0	0	1
DIV REAR CP OPNS	87103L000	19	1	19	1	0	2	0	0	0	0	0	0	0	0	1
DIVISION TOTALS				11604	333	167	116	3849	74	64	117	3	62	36	3	109

UNIT STRUCTURE					EMPLACEMENTS FOR EACH UNIT OF THE GIVEN TYPE FOR A SINGLE LOCATION											
TYPE OF UNIT	SRC	UNIT STRENGTH	NUMBER OF UNITS	TOTAL STRENGTH	TRIPLE STANDARD CONCERTINA	FOUR STRAND FENCE	COMMAND POST	2-MAN POSITION W/OVERHEAD	FIGHTING BUNKER	PERIMETER BUNKER/TOWER	MORTAR POSITION WITH OVERHEAD	OBSTACLE MATERIALS	FIELD ARTILLERY REVETMENT	AIR DEFENSE REVETMENT	HELIPORT	LATRINE
HHC AVN BDE	01042A000	159	1	159	1	0	2	60	0	0	0	0	0	0	0	2
ASLT HEL BN	01045A000	388	1	388	6	6	6	94	4	0	0	0	0	0	1	4
ATK HEL BN	01085A000	231	1	231	6	6	6	16	4	0	0	0	0	0	1	2
AIR RECON SQ	01066A000	316	1	316	2	0	2	98	4	0	0	0	0	0	1	3
CM CO	03057L000	128	1	128	1	0	1	44	1	0	0	0	0	0	0	2
EN BN	05025L000	428	1	428	6	0	6	134	2	0	0	3	0	0	0	4
HHB DIVARTY (ABN)	06202L000	115	1	115	2	0	2	38	0	0	0	0	0	0	0	1
105 T BN 3X6	06208L000	444	3	1332	3	0	3	192	0	0	0	0	18	0	0	4
IN BN ABN	07035L000	680	9	6120	13	0	5	250	4	0	13	0	0	0	0	6
DIV SIG BN (MSE)	11065L200	564	1	564	6	6	6	162	6	0	0	0	0	0	0	5
AG BAND	12113L000	41	1	41	1	0	1	11	0	0	0	0	0	0	0	1
MP CO	19313L000	99	1	99	1	0	1	30	1	0	0	0	0	0	0	1
MI BN CEWI	34265L000	487	1	487	3	3	4	194	1	0	0	0	0	0	0	4
AD BN FAADS ABN	44135L200	436	1	436	2	0	2	198	0	0	0	0	0	48	0	4
HHC DISCOM	63252L000	200	1	200	2	0	2	60	2	0	0	0	0	0	0	2
MAIN SPT BN	63265L000	926	1	926	36	36	2	413	3	16	0	0	0	0	0	8
FWD SPT BN	63255L000	242	3	726	36	36	2	71	3	16	0	0	0	0	0	2
AVN MAINT CO	01953A000	305	1	305	2	2	2	133	0	0	0	0	0	0	0	3
HHC DIV (ABN)	57004L000	258	1	258	1	0	4	89	0	0	0	0	0	0	0	3
HHC BDE (ABN)	57042L000	82	3	246	3	0	3	11	0	0	0	0	0	0	0	1
DIV REAR CP OPNS	87103L000	19	1	19	1	0	2	0	0	0	0	0	0	0	0	1
DIVISION TOTALS				13524	322	167	120	4846	73	64	117	3	54	48	3	125

Unit Barrier/Fortification/Construction Requirements - Airborne Division

Unit Barrier/Fortification/Construction Requirements - Air Assault Division

UNIT STRUCTURE					EMPLACEMENTS FOR EACH UNIT OF THE GIVEN TYPE FOR A SINGLE LOCATION											
TYPE OF UNIT	SRC	UNIT STRENGTH	NUMBER OF UNITS	TOTAL STRENGTH	TRIPLE STANDARD CONCERTINA	FOUR STRAND FENCE	COMMAND POST	2-MAN POSITION W/OVERHEAD	FIGHTING BUNKER	PERIMETER BUNKER/TOWER	MORTAR POSITION WITH OVERHEAD	OBSTACLE MATERIALS	FIELD ARTILLERY REVETMENT	AIR DEFENSE REVETMENT	HELIPORT	LATRINE
HHC AVN BDE	01202A100	97	1	97	1	0	2	29	0	0	0	0	0	0	0	1
ASLT HEL BN	01205A000	313	3	939	6	6	6	57	4	0	0	0	0	0	1	3
CMD AVN BN /GS	01215A000	359	1	359	6	6	6	80	4	0	0	0	0	0	1	3
MDM HEL BN	01245A100	796	1	796	6	6	6	278	6	0	0	0	0	0	2	7
ATK HEL BN	01385A200	302	3	906	6	6	6	51	4	0	0	0	0	0	1	3
AIR RECON SQ	01265A000	327	1	327	2	0	2	104	4	0	0	0	0	0	1	3
CM CO	03057L100	127	1	127	1	0	1	44	1	0	0	0	0	0	0	2
EN BN	05215L000	436	1	436	6	0	6	138	2	0	0	3	0	0	0	4
HHB DIVARTY (AASLT)	06702L000	115	1	115	1	0	2	38	0	0	0	0	0	0	0	1
105 T BN 3X6	06705L000	439	3	1317	3	0	3	190	0	0	0	0	18	0	0	4
IN BN AASLT	07055L000	670	9	6030	13	0	5	245	4	0	13	0	0	0	0	6
DIV SIG BN (MSE)	11065L200	564	1	564	6	6	6	162	6	0	0	0	0	0	0	5
AG BAND	12113L000	41	1	41	1	0	1	11	0	0	0	0	0	0	0	1
MP CO	19343L000	99	1	99	1	0	1	30	1	0	0	0	0	0	0	1
MI BN CEWI	34275L000	487	1	487	3	3	4	194	1	0	0	0	0	0	0	4
AD BN FAADS AASLT	44145L200	470	1	470	2	0	2	215	0	0	0	0	0	48	0	4
HHC DISCOM	53042L000	221	1	221	2	0	2	71	2	0	0	0	0	0	0	2
MAIN SPT BN	63155L000	666	1	666	36	36	2	283	3	16	0	0	0	0	0	6
FWD SPT BN	63145L000	230	3	690	36	36	0	85	3	16	0	0	0	0	0	2
MED CO AIR AMB	08028L000	101	1	101	1	0	1	31	1	0	0	0	0	0	0	1
AVN MAINT CO	01925A000	995	1	995	6	6	6	438	0	0	0	0	0	0	0	8
HHC DIV (AASLT)	67005L000	262	1	262	1	0	4	91	0	0	0	0	0	0	0	3
HHC BDE (AASLT)	67042L000	82	3	246	3	0	3	11	0	0	0	0	0	0	0	1
DIV REAR CP OPNS	87103L000	19	1	19	1	0	2	0	0	0	0	0	0	0	0	1
DIVISION TOTALS				16310	362	207	155	5624	100	64	117	3	54	48	10	150

UNIT STRUCTURE					EMPLACEMENTS FOR EACH UNIT OF THE GIVEN TYPE FOR A SINGLE LOCATION											
TYPE OF UNIT	SRC	UNIT STRENGTH	NUMBER OF UNITS	TOTAL STRENGTH	TRIPLE STANDARD CONCERTINA	FOUR STRAND FENCE	COMMAND POST	2-MAN POSITION W/OVERHEAD	FIGHTING BUNKER	PERIMETER BUNKER/TOWER	MORTAR POSITION WITH OVERHEAD	OBSTACLE MATERIALS	FIELD ARTILLERY REVETMENT	AIR DEFENSE REVETMENT	HELIPORT	LATRINE
CM CO	03377L000	73	1	73	1	0	1	17	1	0	0	0	0	0	0	1
EN CO	05113L000	196	1	196	1	0	1	78	1	0	0	1	0	0	0	2
AIR CAV SQDN	01465A200	552	1	552	11	0	2	256	0	0	0	0	0	0	1	5
AR CAV SQDN (M1A1)	17485L000	865	3	2595	11	0	2	165	0	0	0	0	8	0	0	7
MI CO CEWI	34114L000	184	1	184	1	1	1	72	1	0	0	0	0	0	0	2
AD BTRY	44414L300	163	1	163	1	0	1	72	0	0	0	0	0	6	0	2
SPT SQDN	63065L000	818	1	818	6	6	0	409	0	4	0	0	0	0	0	7
HHT CAV RGT	17442L000	150	1	150	1	0	4	35	0	0	0	0	0	0	0	2
DIVISION TOTALS				4731	55	7	16	1434	3	4	0	1	24	6	1	42

Unit Barrier/Fortification/Construction Requirements - Armored Cavalry Regiment

Unit Barrier/Fortification/Construction Requirements - Separate Armor Brigade

UNIT STRUCTURE					EMPLACEMENTS FOR EACH UNIT OF THE GIVEN TYPE FOR A SINGLE LOCATION											
TYPE OF UNIT	SRC	UNIT STRENGTH	NUMBER OF UNITS	TOTAL STRENGTH	TRIPLE STANDARD CONCERTINA	FOUR STRAND FENCE	COMMAND POST	2-MAN POSITION W/OVERHEAD	FIGHTING BUNKER	PERIMETER BUNKER/TOWER	MORTAR POSITION WITH OVERHEAD	OBSTACLE MATERIALS	FIELD ARTILLERY REVETMENT	AIR DEFENSE REVETMENT	HELIPORT	LATRINE
EN BN	05146L000	433	1	433	6	0	6	157	0	0	0	3	0	0	0	4
155SP BN 3X8-2X1	06375L300	753	1	753	3	0	3	27	0	0	0	0	24	0	0	7
IN BN MECH (BFVS)	07245L000	830	1	830	14	0	2	80	0	0	6	0	0	0	0	7
AR BN (M1A1)	17375L000	534	2	1068	11	0	2	35	0	0	0	0	0	0	0	5
AR CAV SQDN (M1A1/M3)	17387L000	152	1	152	2	0	1	22	0	0	0	0	0	0	0	2
MI CO DS	34144L000	32	1	32	1	1	1	6	0	0	0	0	0	0	0	1
SIG CO	11???L???	175	1	175	2	2	2	48	2	0	0	0	0	0	0	2
SPT BN 2X1	63085L100	716	1	716	36	36	2	308	3	16	0	0	0	0	0	6
HHC BDE	87102L100	286	1	286	1	0	4	103	0	0	0	0	0	0	0	3
DIVISION TOTALS				4445	87	39	25	821	5	16	6	3	24	0	0	42

UNIT STRUCTURE					EMPLACEMENTS FOR EACH UNIT OF THE GIVEN TYPE FOR A SINGLE LOCATION											
TYPE OF UNIT	SRC	UNIT STRENGTH	NUMBER OF UNITS	TOTAL STRENGTH	TRIPLE STANDARD CONCERTINA	FOUR STRAND FENCE	COMMAND POST	2-MAN POSITION W/OVERHEAD	FIGHTING BUNKER	PERIMETER BUNKER/TOWER	MORTAR POSITION WITH OVERHEAD	OBSTACLE MATERIALS	FIELD ARTILLERY REVETMENT	AIR DEFENSE REVETMENT	HELIPORT	LATRINE
EN BN	05143L000	433	1	433	6	0	6	137	2	0	0	3	0	0	0	4
155 SP BN 3X8-1X2	06375L400	777	1	777	3	0	3	27	0	0	0	0	24	0	0	7
IN BN MECH (BFVS)	07245L000	830	2	1660	14	0	2	80	0	0	6	0	0	0	0	7
AR BN (M1)	17375L000	534	1	534	11	0	2	35	0	0	0	0	0	0	0	5
AR CAV SQDN (M1/M3)	17367L000	152	1	152	2	0	1	22	0	0	0	0	0	0	0	2
MI CO DS	34144L000	32	1	32	1	1	1	6	0	0	0	0	0	0	0	1
SIG CO	11???L???	175	1	175	1	1	1	68	1	0	0	0	0	0	0	2
SPT BN 1X2	63085L200	708	1	708	36	36	2	304	3	16	0	0	0	0	0	6
HHC BDE	07102L200	286	1	286	1	0	4	103	0	0	0	0	0	0	0	3
DIVISION TOTALS				4757	89	38	24	862	6	16	12	3	24	0	0	44

Unit Barrier/Fortification/Construction Requirements - Separate Mechanized Brigade

Unit Barrier/Fortification/Construction Requirements - Separate Infantry (LT) Brigade

UNIT STRUCTURE					EMPLACEMENTS FOR EACH UNIT OF THE GIVEN TYPE FOR A SINGLE LOCATION											
TYPE OF UNIT	SRC	UNIT STRENGTH	NUMBER OF UNITS	TOTAL STRENGTH	TRIPLE STANDARD CONCERTINA	FOUR STRAND FENCE	COMMAND POST	2-MAN POSITION W/OVERHEAD	FIGHTING BUNKER	PERIMETER BUNKER/TOWER	MORTAR POSITION WITH OVERHEAD	OBSTACLE MATERIALS	FIELD ARTILLERY REVETMENT	AIR DEFENSE REVETMENT	HELIPORT	LATRINE
EN CO	05153L000	160	1	160	2	0	2	40	2	0	0	1	0	0	0	2
105T BN 3X6	06185L000	485	1	485	3	0	3	213	0	0	0	0	18	0	0	4
IN BN LIGHT	07055L000	678	3	2034	14	0	5	249	4	0	5	0	0	0	0	6
CAV TRP	17787L000	96	1	96	4	0	1	22	0	0	0	0	0	0	0	1
MI CO DS	34724L000	53	1	53	1	1	1	17	0	0	0	0	0	0	0	1
SIG CO	11???L???	181	1	181	1	1	1	71	1	0	0	0	0	0	0	2
SPT BN	63445L1000	593	1	593	36	36	2	247	3	16	0	0	0	0	0	5
HHC BDE	07402L000	299	1	299	1	0	4	110	0	0	0	0	0	0	0	3
DIVISION TOTALS				3901	90	38	29	1467	18	16	15	1	18	0	0	36

UNIT STRUCTURE		EMPLACEMENTS FOR EACH UNIT OF THE GIVEN TYPE FOR A SINGLE LOCATION											
TYPE OF UNIT	NUMBER OF PERSONNEL	TRIPLE STANDARD CONCERTINA	FOUR STRAND FENCE	COMMAND POST	2-MAN POSITION W/OVERHEAD	FIGHTING BUNKER	PERIMETER BUNKER/TOWER	MORTAR POSITION WITH OVERHEAD	OBSTACLE MATERIALS	FIELD ARTILLERY REVETMENT	AIR DEFENSE REVETMENT	HELIPORT	LATRINE
HHC, HHB (ALL TYPES)	100	1	0	2	30	0	0	0	0	0	0	0	1
AV - AVN BN	300	6	6	6	30	6	0	0	0	0	0	1	3
EN - EN BN (CBT LT ASLT, CBT MECH, CBT)	400	6	0	6	120	2	0	0	3	0	0	0	4
FA - TGT ACQ BTRY	100	1	0	1	40	0	0	0	0	5	0	0	1
FA - 155MM T BN	200	3	0	3	70	0	0	0	0	24	0	0	2
FA - 155MM SP BN	700	3	0	3	27	0	0	0	0	24	0	0	6
FA - MLRS BTRY	100	1	0	1	40	0	0	0	0	9	0	0	1
AD - AD BN	600	2	0	2	280	0	0	0	0	0	24	0	5
UNITS OF TYPE CA, AG, JA, PA, PO, TC, MD, MI, MP	100	1	1	1	25	1	1	0	0	0	0	0	1
UNITS OF TYPE MT, SC, CM, OD, OM, REMAINING EN	100	2	2	1	17	1	1	0	0	0	0	0	1

Unit Barrier/Fortification/Construction Requirements - Corps and EAC Support Units

Appendix F: Base Development Task Performance Specifications

The calculations in Chapter 3 and the C4 model described in Chapter 5 both use the formula:

$$\text{Total Class IV Materials Per Day} = \sum_{TASK} (M_{TASK} * N_{TASK})$$

where M_{TASK} is the number of pounds of Class IV material required for a single task of type TASK, N_{TASK} is the number of tasks of type TASK performed per day, and the sum is taken over all tasks requiring the use of Class IV supplies. Information from particular scenario situations is generally required to determine N_{TASK}. The derivation of M_{TASK} for base development tasks is provided by the tables in this appendix.

Each task that requires Class IV supplies may usually be accomplished in a number of different ways, depending on terrain, climate, engineering specifications, local construction practices, and the available time and materials. Fortunately, the study only needed a credible weight of materials for each task, a requirement that avoided the intricate details involved in choosing suitable construction methods for each situation. The study criteria was very simple: choose a method of task performance that falls within current standard procedures and also represents an austere approach requiring a minimal weight of Class IV supplies. This was in keeping with the study assumption that the computed Class IV requirement would be close to minimal and that the adverse conditions of terrain, climate, specific engineering concerns, etc., would only increase the requirement.

The tables in this appendix contain the specifications for each standard base development task. The intention in citing this information is not to imply that the chosen method is appropriate for all cases but to show that the Class IV weight requirement M_{TASK} was derived from an actual theater construction method and to provide enough detail data to allow the reader to determine what was or was not included. The task performance methods cited here are linked to facilities from the Army Facilities Components System, with the particular facilities identified by description, AFCS facility number, and quantity. For the tasks

included in the FASTALS construction model, these specifications correspond to the ESSC workload factors. For the other tasks, representative AFCS facilities or installations were chosen after consultation with the AFCS team at Huntsville Division and with ENCOM points of contact.

For each task, a complete bill of materials is provided, including the national stock number (NSN) and description of each item, the quantity required of its unit of issue, the total weight, and the item's class of supply. The AFCS materials master file provided the material descriptions and unit weights in most cases. Data not provided by AFCS was taken from the Army Master Data File distributed by the U.S. Army Logistics Support Activity. The AMDF also served as the source for the supply classification. Items not contained in the AMDF database were assigned a supply classification to agree with supplies of similar description wherever possible, otherwise the class of supply was left blank. The appendix ends with a glossary of unit-of-issue terms.

Representative Bills of Materials for Base Development Tasks

MSR Damage Repair - 1 Mile

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
11100CE	CRATER FILL,DEBRIS/CRUSHED STONE	0.3
85290AV	SOIL-CEMENT FILLED SANDBAG,HEADWALLS	0.2
85110BN	ROAD CLASS B, 6@ STABILIZED SURFACE	1.0

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
3	4930	0	0	4933	2752.0

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
8135005796487	PLASTIC SHEET,BLACK 32X100FT	0.1	SH	3	2
5610002504676	CEMENT PORT GEN CONC CONSTR 94LB	49.0	BG	4606	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	1243.4	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	1043.6	CD	0	4
561000Z010003	MINERAL FILLER,LOCAL PROCUREMENT	465.0	CD	0	4
8105009357101	BAG SAND ACRYLIC 26 IN LGX14 IN WI	12.0	HD	324	4

Highway bridge damage repair - 80 ft Span

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
85120HE	80-ft Bailey bridges	2
85120EC	Pier	1

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
286	61490	6402	4766	78844	0.0

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
5306002637725	BOLT MACHINE 3/4 X 18 IN W/NUT	119.0	EA	286	2
5315001623124	SPIKE COMMON 7IN	15.0	LB	15	4
5420003556596	CLAMP TRANSOM BAILEY B11844-D 26745	16.0	EA	110	4
5510001380285	LUMBER	600.0	BF	1500	4
5510002605931	PILE WD TYPE 2 CL B 45FT LG COASTAL	21.0	EA	37847	4
5510005017119	LUMBER	1654.0	BF	4135	4
5510005017121	LUMBER	1536.0	BF	3840	4
5510005017133	LUMBER	107.0	BF	268	4
5510005017160	LUMBER	160.0	BF	400	4
5510005017185	LUMBER	384.0	BF	960	4
5510005017224	LUMBER	1680.0	BF	4200	4
5510005017248	LUMBER	3286.0	BF	8215	4
5420002670026	BRIDGE CONVERSION SET NO.3	0.8	EA	4358	7
5420005303784	BRIDGE FIXED BAILEY	0.8	SE	1867	7
5420005303785	ERECTION SET,FIXED BRIDGE	0.8	SE	177	7
5306002637727	BOLT MACH,.750-10UNC,22IN W/NUT,STL	83.0	EA	239	9
5306006388298	BOLT MACHINE 3/4 X 10 IN W/NUT	27.0	EA	39	9
5310008098536	PIPE,AIR CONDITIONER	458.0	EA	4154	9
5340002613053	BOLT DRIFT STEEL SQ HD 3/4X 20IN LG	96.0	EA	202	9
5340002613057	BOLT DRIFT STEEL SQ HD 3/4X 28IN LG	46.0	EA	132	9
5306010422356	ROD CONT THRD 1 1/4DIAX40 MK AB1	30.0	EA	500	
5420010459749	GLULAM CAP 12X12X32'	4.0	EA	5400	

Representative Bills of Materials for Base Development Tasks

Railroad damage repair -- Salvaged materials only

Railroad bridge damage repair - 80 ft Span

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
86030TP	Span (40 ft) and pier	2

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
0	99833	0	5678	128573	0.0

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
5315001645121	NAIL	22.0	LB	22	4
5420010550720	PL BENT CONN1/2X9X1-5 1/4MK CP33	16.0	EA	336	4
5420010550721	PL BEARING4X15X2-8 MK RB2	8.0	EA	4315	4
5420010550723	DIAPHR STL MC18X42.7 MK RED20	4.0	EA	1064	4
5420010550734	STRINGER STL W36X230 MK SRR31R	2.0	EA	14209	4
5420010550746	BRACING STL L6X6X3/8 MK RL33	8.0	EA	886	4
5420010552130	PLATE STL 3/8X8X2-0 MK TP1	24.0	EA	471	4
5510001603791	TIE RAILROAD WOOD 7IN X 9 IN X 10FT	84.0	EA	9912	4
5510002605932	PILE WD TYPE 2 CL B 50FT LG COASTAL	24.0	EA	46668	4
5510005017119	LUMBER	1922.0	BF	4805	4
5510005017121	LUMBER	1110.0	BF	2775	4
5510005017133	LUMBER	1280.0	BF	3200	4
5510005017134	LUMBER	268.0	BF	670	4
5510005017150	LUMBER	80.0	BF	200	4
5510005017183	LUMBER	120.0	BF	300	4
5510005017220	LUMBER	1728.0	BF	4320	4
5510005017221	LUMBER	1152.0	BF	2880	4
5510005017231	LUMBER	1120.0	BF	2800	4
2250001994532	SPIKE TRACK 5/8X6 IN SQUARE HEAD	1000.0	LB	1050	9
2250002880185	JOINT BAR RAIL 90LB/YD ARA-A RAIL	28.0	PR	728	9
2250002880186	TIE PLATE RAILWAY CANTED RAIL SEAT	180.0	EA	2070	9
2250006190204	RAIL ANCHOR RAILWAY 90LB/YD	40.0	EA	30	9
5306002637766	BOLT MACH,1.000-8UNC,16IN,W/NUT,STL	88.0	EA	351	9
5306002637768	BOLT MACH,1.000-8UNC,20IN,W/NUT,STL	48.0	EA	233	9
5306002637769	BOLT MACH,1.000-8UNC,22IN,W/NUT,STL	72.0	EA	382	9
5306002742738	BOLT OVAL NECK,1.0-8UNC,5IN,STL	180.0	EA	270	9
5306004310995	BOLT LAG .50X8.00IN HEX GALV	122.0	EA	1	9
5306004346324	BOLT ASSY,.875-9UNC,3.5IN,NT/WA,HIS	10.0	EA	0	9
5306004411119	BOLT ASSY,.875-9UNC,2.5IN,NT/WA,HIS	66.0	EA	1	9
5306004411125	BOLT ASSY,.875-9UNC,2.75IN,NT/WA HI	20.0	EA	0	9
5310005847955	WASHER FLAT CAD 1-1/16IN ID X2.5IN	1536.0	EA	292	9
5310010093094	WASHER,LOAD IND FOR 7/8 DIA BOLT	218.0	EA	2	9
5310010464614	WASHER FLAT HS STL 15/16 1DX1 3/4OD	218.0	EA	15	9
5340002613053	BOLT DRIFT STEEL SQ HD 3/4X 20IN LG	88.0	EA	185	9
5340002613054	BOLT DRIFT STEEL SQ HD 3/4X 22IN LG	26.0	EA	68	9
2250002773759	RAIL TEE 90LB/YD STEEL 40FT LENGTH	14.0	EA	16380	
5306002637767	BOLT MACH,1.000-8UNC,18IN,W/NUT,STL	556.0	EA	2458	
5306004411113	BOLT ASSY,.875-9UNC,2.25IN,NT/WA,HI	120.0	EA	1	
5306010422356	ROD CONT THRD 1 1/4DIAX40 MK AB1	18.0	EA	300	
5420005549119	BOLT HOOK TIE UNC 1IN DIA X13.5IN	112.0	EA	560	
5420010541159	DIAPHR STL W33X118 MK RD20	2.0	EA	1314	
5420010550699	PL EXP ROCKER 4X8X2-8 MK RR3	4.0	EA	1016	
5420010550705	PL EXP ROCKER 4X8X2-8 MK RR4	4.0	EA	1033	

Representative Bills of Materials for Base Development Tasks

Pipeline damage repair 1 mile

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
12520AD	P/L DMG REPAIR KIT, 6IN ALUM, 200FT	0.4
12530BB	P/L PUMP STN MAIN W/2-800 GPM PUMPS	0.6
12592HH	P/L TUNNEL/BRIDGE XING, 6IN, 500FT	0.1

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
140	16002	3704	100	19946	0.0

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
4210009651108	EXTINGUISHER FIRE DRY CHEM 20LB CAP	3.6	EA	140	2
432000Z430221	PUMP, 10 GPM FOR MAIN PUMP STN	0.6	EA	36	4
471000Z430177	PIPE CULV NEST TYPII 2SEC 18X25.5IN	37.2	EA	1345	4
471000Z430269	PIPE ASSAULT ALUM MOD SG 6INX19FT	4.4	LG	480	4
471000Z430303	PIPE NIPPLE, 6IN MOD SGL GRV X9.5FT	30.0	EA	2710	4
473000Z430007	TEE ASSY. 4IN. MXMXF CAM LOCK	0.6	EA	30	4
473000Z430182	PIPELINE CASING INSULATOR 6INX13IN	3.3	EA	20	4
473000Z430222	STRAINER ASSY, 6IN, MOD SGL GRV	0.6	EA	5451	4
473000Z430226	COUPLING HALF, 1IN FEM CL X EXT THD	1.2	EA	1	4
473000Z430227	COUPLING HALF, 1IN CAP, CAM LOCK	0.6	EA	0	4
473000Z430229	BUSHING, RED, 3IN X 1IN NPT	0.6	EA	2	4
473000Z430230	COUPLING HALF, 3IN FEM CL X INT THD	0.6	EA	2	4
473000Z430272	COUPLING, CLAMP, 6IN, MOD SGL GRV	79.4	EA	1906	4
473000Z430286	TEE, 6X6X6IN, ALUM MOD SG 650 PSI	3.6	EA	54	4
473000Z430292	ELBOW, 90 DEG, 6IN ALUM MOD SGL GRV	28.8	EA	304	4
482000Z430223	VALVE ASSY, RED, 6IN MSG X 1IN CL	0.6	EA	42	4
482000Z430225	VALVE, BALL, 1IN, NPT, FXF, 150PSI	0.6	EA	9	4
482000Z430287	VALVE SKID CHECK, 6IN MOD SG, 300#	1.8	EA	1440	4
482000Z430289	VALVE SKID, GATE, 6IN MOD SG, 300#	2.4	EA	1992	4
8105009357101	BAG SAND ACRYLIC 26 IN LGX14 IN WI	6.6	HD	178	4
4320011933430	PUMP UNIT,CENTRIFUG	1.2	EA	3600	7
5430002688187	TANK FABRIC COLLAPSIBLE 3000 GAL	0.6	EA	104	7
4720012264829	HOSE ASSY DISCH 1 IN X 25 FT	4.8	EA	100	9
4730000847435	COUPLING HALF,QUICK DISCONNECT,ALUM	1.2	EA	0	9
4730003600715	COUP HALF QUICK DISCONN PLUG, 1 IN.	1.2	EA	0	9
5310000889167	WASHER, FLAT, RUBBER, 1 IN.	1.8	EA	0	9
5330000889166	GASKET, 3 IN RUBBER	0.6	EA	0	9

Port damage repair -- 1000 STON throughput

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
15250AU	Port damage repair	1

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
55	58100	0	330	58485	0.0

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
4030002434441	CLAMP WIRE ROPE SADDLED U-BOLT 5/8	55.0	EA	55	2
5510002605930	PILE WD TYPE 2 CL B 40FT LG COASTAL	35.0	EA	58100	4
4010002854207	WIRE ROPE STEEL 5/8 IN DIA	330.0	FT	330	9

Representative Bills of Materials for Base Development Tasks

Troop camp construction -- 250 soldiers

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
83190AA	Cesspool	2
87190AA	Site preparation 1 acre	5.7
85130FW	Road prep 1 mile	0.1
85110BM	Road surface 1 mile	0.1
85210BR	Hardstand prep 1000 SY	0.5
85110DF	Hardstand surface 1000 sy	0.5

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
0	39938	0	1368	41306	328.6

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
4710002731037	PIPE CULV NEST STL 2SECT 3FTX25.5IN	75.5	EA	8305	4
4710002731038	PIPE CULV NEST STL 2SECT 4FTX25.5IN	99.5	EA	14228	4
4710002731039	PIPE CULV NEST STL 2SECT 2FTX25.5IN	15.5	EA	837	4
473000Z020073	CROSS 6 IN X 6 IN X 4 IN CI	2.0	EA	12	4
473000Z020080	REDUCER 6 IN X 4 IN CI	4.0	EA	8	4
473000Z020091	TEE 4 IN X 4 IN X 4 IN CI	36.0	EA	180	4
473000Z020101	90 DEGREE BEND 4 IN CI	8.0	EA	32	4
5610002504676	CEMENT PORT GEN CONC CONSTR 94LB	144.0	BG	13536	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	187.9	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	100.5	CD	0	4
561000Z010003	MINERAL FILLER,LOCAL PROCUREMENT	40.2	CD	0	4
811000Z020001	KK GAL DRUM	40.0	EA	2800	4
4710002731042	PIPE CULV NEST STL 2SECT 1.5X25.5IN	21.7	EA	738	9
5335002629445	WIRE FABRIC WELDED 6X6 MESH 750SQFT	2.0	RO	630	9

Admin space construction -- 25000 SF

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
85210BC	Hardstand 1000 SY	3
72321CB	Latrine	14
61050JN	40X100 Gen admin bldg	5
61050HN	40X50 Gen admin bldg	4
81240BL	Electrical distribution 25000 SF	1
87190AA	Site preparation 1 acre	6

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
12813	237882	17880	25883	295454	411.9

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
4030008649037	CLAMP GUY 3-BOLT 3/8 OR 7/16 IN STR	30.0	EA	68	2
4520005400557	HEATER SPACE FLR 70000 BTU/ DIESEL	84.0	EA	11340	2
8135005796489	PLASTIC SHEET TRANSP 6 MIL 12X100FT	28.1	RO	1405	2
4710002731038	PIPE CULV NEST STL 2SECT 4FTX25.5IN	300.0	EA	42900	4
5315000104655	NAIL COMMON WIRE STEEL 4D	0.4	BX	20	4
5315000104659	NAIL COMMON WIRE STEEL 8D	0.1	BX	5	4
5315006647034	STAPLE CABLE 3/8 IN SPREAD 1 IN LG	33.3	BX	18	4
5315007533881	NAIL COMMON 2 IN 6D	1.1	PG	6	4
5315007533883	NAIL COMMON 3 IN 10D	1.1	PG	6	4
541000Z520202	PREFAB PORTABLE LATRINE	14.0	EA	3220	4
5510001344008	LUMBER	70.0	BF	175	4
5510002206078	LUMBER SOFTWOOD BD 2 COM 1X4XRL	93.6	BF	251	4
5510002206080	LUMBER SOFTWOOD BD 2 COM 1X6XRL	727.2	BF	1949	4
5510002206194	LUMBER,SOFTWOOD DIM 2X4XRL	1908.0	BF	4770	4
5510002729060	LUMBER SOFTWOOD BD 2 COM 1X3XRL	763.2	BF	2045	4
5510009838815	POLE WOOD PRESSURE TRTD 25 FT CL 6	12.0	EA	4440	4

Representative Bills of Materials for Base Development Tasks

5530001297833	PLYWOOD AC EXT 5-PLY 3/4X48X96 IN	46.8	SH	3374	4
5610002504676	CEMENT PORT GEN CONC CONSTR 94LB	1840.8	BG	173035	4
5610002744148	FILLER EXP JOINT BITUM 36INWX5FT LG	499.2	EA	250	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	274.6	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	137.3	CD	0	4
5640008499850	BUILDING BOARD TEMPERED 1/4X4X8	27.9	SH	698	4
592500Z550001	CB PNL 208V MB1-70A/3P BB30-20A/1P	9.0	EA	702	4
597000Z550003	BRKT W INSUL FOR 1-1/4 TO 2IN CND	36.0	EA	18	4
541000Z311036	BLDG.LW.STL.PNL.42X51X10 ALL CLIMAT	0.4	EA	5480	7
541000Z311042	BLDG.LW.STL.PNL.42X102X10 ALL CLIMA	0.5	EA	12400	7
4010002212709	WIRE STRAND STEEL 3/8IN GALV 2500FT	0.1	RL	136	9
5305001801964	SCREW,WOOD,.164WD,1-1/4IN,STL,CAD	0.3	HD	0	9
5305006882350	SCREW MACHINE 0.216-24 UNC,3/8IN	2980.0	EA	60	9
5305008830628	SCREW,TAP,.164-15FORM,.531IN,GALV	0.3	HD	0	9
5306001451064	BOLT,LAG,.375WD,3IN,STL	1.8	BX	0	9
5310009517209	WASHER FLAT 11/16 ID 1-3/4 OD	0.1	HD	1	9
5335002629445	WIRE FABRIC WELDED 6X6 MESH 750SQFT	49.9	RO	15718	9
5340000504659	STRAP RTNG 1.5 IN HVY WALL STL CND	0.9	BX	4	9
5340002402593	HINGE TEE 4IN	4.0	PR	2	9
5340006641363	BOLT BARREL STEEL 3/8X4 INCH	4.0	EA	1	9
5930006605584	SWITCH,SPST,20A 125V,TOGGLE	140.0	EA	4	9
5935002545471	ELECT.RECP.120V-20A DUPLEX	212.0	EA	64	9
5940002287912	CONN SPLITBOLT NO. 8 OR 6 AWG 10/PG	7.0	PG	0	9
5940002399029	CONNECTOR SPLITBOLT NO. 2 AWG 10/PG	4.0	PG	18	9
5940002403434	CONNECTOR SPLITBOLT 0 - 00 AWG 5/PG	13.5	PG	9	9
5940002705852	SPLICE CONDUCTOR WIRENUT 10-16	14.0	HD	4	9
5940008657528	CONNECTOR SPLITBOLT NO. 4 AWG 5/PKG	9.0	PG	3	9
5970002636891	INSULATOR STRAIN CLEVIS SECONDARY	56.0	EA	140	9
5970004194291	TAPE ELECTRIC PLASTIC 3/4 INCH WIDE	37.0	RO	16	9
5975001008707	BUSHING 1.5 IN HVY WALL STL CONDUIT	9.0	EA	2	9
5975001008779	LOCKNUT,ELECTRICAL,1-1/2IN X 11-1/2	0.9	BX	0	9
5975001521094	BUSHING 3/4 IN HVY WALL STL CONDUIT	18.0	EA	1	9
5975001521119	BEND 90 DEG 1.500" HVY WALL STL CND	9.0	EA	0	9
5975001521139	COUPLING 1-1/2INX2IN HVY WL STL CND	18.0	EA	0	9
5975001521144	BOX CONN NMC 3/8 IN DIA TO 1/2IN KO	1964.0	EA	334	9
5975001590969	OUTLET BOX,4X4"1/2"TO3/4"KNOCKOUT	350.0	EA	35	9
5975001781209	CONDUIT 1.5 INCH RIGID HVY WALL STL	9.0	LG	245	9
5975001881164	COVER BOX SFC MTD DUPLEX RECEPT	212.0	EA	53	9
5975002286004	CONDUIT 3/4 INCH RIGID HVY WALL STL	9.0	LG	19	9
5975002803746	ENTRANCE CAP 1.5 IN HVY STL CONDUIT	9.0	EA	26	9
5975002810057	COVER JUNCTION BOX 4IN SQ FLAT	280.0	EA	56	9
5975002810090	JCT BOX RECT SFC MTD FOR SW OR RECP	352.0	EA	4	9
5975005014924	COVER BOX STL SFC MTD TOGGLE SWITC	140.0	EA	18	9
5975006427261	LOCKNUT 3/4 INCH HVY STL CND 50/PG	0.9	PG	1	9
5975008784868	GROUND ROD 3/4INX10FT STL W/CU COAT	9.0	EA	45	9
6145001990222	WIRE WP NO. 2 7-STR CU POLYETHYLENE	715.0	FT	193	9
6145001990230	WIRE WP 1/0 7-STR CU POLYETHYLENE	2150.0	FT	172	9
6145002994456	CABLE 1/C #6 AWG 7-STR CU BARE MHD	180.0	FT	14	9
6145005191332	CABLE 3/C&GND 12 AWG SOL CU NMC TTJ	6020.0	FT	963	9
6145005192718	CABLE 2/C&GND 12 AWG SOL CU NMC TTJ	13660.0	FT	1229	9
6145009546045	CABLE 1/C #4 AWG 7STR CU THW RED	270.0	FT	46	9
6145012046474	CABLE 1/C #4 AWG 7-STR CU THW BLUE	270.0	FT	46	9
6145012073813	CABLE 1/C #4 AWG 7STR CU THW BLACK	270.0	FT	46	9
6210008658451	FXTR LTG FLUOR INDL RS 2-40 W STL	280.0	EA	3920	9
6240001522987	LAMP FLUORESCENT F40T12 COOL WHITE	612.0	EA	1224	9
6240009908191	LAMP INCANDESCENT 115V 100W A21 BLB	122.0	EA	26	9
9515002306695	STEEL SHEET GALV .187X36X120IN	42.0	SH	985	9
4030002420019	ROD ANCHOR STL GALV .50IN X 72IN	7.0	EA	63	
5305009010768	SCREW,WOOD,0.190 WOOD,2IN,STL,CAD	15.8	HD	0	
5650002701483	ROOFING FELT 15 LB 3 FT WIDE 324 SF	9.4	RO	470	
6145009495200	CABLE 1/C #4 AWG 7STR CU THW WHITE	270.0	FT	43	
6210008937241	FXTR LTG WP 100 W WALL MTG STL	70.0	EA	420	

Representative Bills of Materials for Base Development Tasks

Gen supply storage construction -- 100,000 SF

COVERED STORAGE FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
93170AP	BUILDING,RELMS,40X100X16	4.0
93170BG	BUILDING,RELMS,60X200X24	5.0
72321DB	Latrine	2.0
84330AC	Fire Protection Sump 10000 gal	2.0
85110AT	Road	1.0
87190AA	Site preparation 1 acre	15.8

OPEN STORAGE FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
72321DB	Latrine	1.0
84330AC	Fire Protection Sump 10000 gal	1.0
85110AT	Road	1.0
87190AA	Site preparation 1 acre	15.8

COVERED STORAGE MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
9	505046	0	2955	508010	3398.0

OPEN STORAGE MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
5	9199	0	199	9403	3142.5

COVERED STORAGE

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
8305005595047	SCREENING INSECT NON-METAL 48IN WD	14.0	YD	9	2
414000Z520203	VENTILATOR TURBINE GALVANIZED	2.0	EA	10	4
473000Z380026	TANK FITTING, 1.25 IN PVC	2.0	EA	1	4
5315000104655	NAIL COMMON WIRE STEEL 4D	0.6	BX	30	4
5315000104659	NAIL COMMON WIRE STEEL 8D	7.0	BX	350	4
5315007533883	NAIL COMMON 3 IN 10D	2.2	PG	11	4
5315007533885	NAIL COMMON 3.5 IN 16D	8.0	PG	40	4
5450013393339	STEEL, COIL, GALVANIZED, 24" G-60	78.3	CL	391500	4
5510002206078	LUMBER SOFTWOOD BD 2 COM 1X4XRL	46.0	BF	123	4
5510002206080	LUMBER SOFTWOOD BD 2 COM 1X6XRL	134.0	BF	359	4
5510002206082	LUMBER SOFTWOOD BD 2 COM 1X8XRL	260.0	BF	697	4
5510002206194	LUMBER,SOFTWOOD DIM 2X4XRL	530.0	BF	1325	4
5510002206196	LUMBER SOFTWOOD DIM 2 COM 2X6XRL	80.0	BF	214	4
5510002729060	LUMBER SOFTWOOD BD 2 COM 1X3XRL	28.0	BF	75	4
5510005519658	LUMBER SOFTWOOD DIM TRTD 4X6XRL	180.0	BF	482	4
5510005519869	LUMBER SOFTWOOD DIM TRTD 1;2X10XRL	600.0	BF	1608	4
5510007200567	LUMBER SOFTWOOD DIM 2 COM 2X2XRL	34.0	BF	91	4
5610002504676	CEMENT PORT GEN CONC CONSTR 94LB	122.0	BG	11468	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	1595.4	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	1270.6	CD	0	4
561000Z010003	MINERAL FILLER,LOCAL PROCUREMENT	532.0	CD	0	4
5680002671666	STEEL BAR REINFORCING 3/8 IN DIA	12520.0	LG	95152	4
5680002671669	STEEL BAR REINFORCING 3/4 IN DIA	24.0	LG	722	4
8030002430948	CALKING COMPOUND,GUN GREY GAL CAN	2.0	GL	30	4
804000Z020001	HYPALON LINER ADHESIVE	1.0	GL	8	4
933000Z020001	LINER BLANKET 15000 SF HYPALON	0.2	EA	750	4
4710002731041	PIPE CULV NEST STL 2SECT 1FTX25.5IN	4.0	EA	96	9
4710005548695	PIPE, PLASTIC, 1.25 IN. 100 FT LONG	0.6	CL	16	9
4710006399441	PIPE STEEL THREAD 3/4 X RL	1800.0	FT	2340	9
4730000825975	TEES NYLON FOR 1.25 N PLASTIC PIPE	2.0	EA	1	9
4730009083193	CLAMP,HOSE,2.0-1.063IN,PL-FLX HOSE	8.0	EA	1	9
5306004129797	BOLT LAG 1/2IN DIA X 6IN LONG	34.0	EA	14	9

Representative Bills of Materials for Base Development Tasks

5315001619839	STAPLE WIRE CLOTH 7/32W X 7/16IN LG	0.2	LB	0	9
5315001645126	NAIL COMMON 3D	0.2	BX	1	9
5315007533886	NAIL COMMON 20D	16.0	LB	16	9
5315008892735	NAIL CORR ROOF/WASH 2IN	2.0	BX	4	9
5335002289207	WIRE FABRIC 3X100FT.RO .453IN MESH	1.0	RO	86	9
5340002349521	LATCH THUMB 12 INCH LONG LATCH BAR	2.0	EA	8	9
5340002402593	HINGE TEE 4IN	2.0	PR	1	9
9515002365495	STEEL SHEET CARBON .0276X48X96INGLV	0.6	SH	31	9
9515008119184	STEEL SHEET CORRUG 26X108X28 GAGE	6.0	SH	122	9
9520005961813	ANGLE, STRUCTUAL STEEL	4360.0	FT	218	9
4730010436734	ADAPTER, STRAIGHT, 1.25 IN PLASTIC	2.0	EA	0	
5305012764262	SCREW, SELF DRILLING #12 X 3/4"	28.0	HD	0	

OPEN STORAGE

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
8305005595047	SCREENING INSECT NON-METAL 48IN WD	7.0	YD	5	2
414000Z520203	VENTILATOR TURBINE GALVANIZED	1.0	EA	5	4
473000Z380026	TANK FITTING, 1.25 IN PVC	1.0	EA	0	4
5315000104655	NAIL COMMON WIRE STEEL 4D	0.3	BX	15	4
5315000104659	NAIL COMMON WIRE STEEL 8D	3.5	BX	175	4
5315007533883	NAIL COMMON 3 IN 10D	1.1	PG	6	4
5315007533885	NAIL COMMON 3.5 IN 16D	4.0	PG	20	4
5510002206078	LUMBER SOFTWOOD BD 2 COM 1X4XRL	23.0	BF	62	4
5510002206080	LUMBER SOFTWOOD BD 2 COM 1X6XRL	67.0	BF	180	4
5510002206082	LUMBER SOFTWOOD BD 2 COM 1X8XRL	130.0	BF	348	4
5510002206194	LUMBER,SOFTWOOD DIM 2X4XRL	265.0	BF	663	4
5510002206196	LUMBER SOFTWOOD DIM 2 COM 2X6XRL	40.0	BF	107	4
5510002729060	LUMBER SOFTWOOD BD 2 COM 1X3XRL	14.0	BF	38	4
5510005519658	LUMBER SOFTWOOD DIM TRTD 4X6XRL	90.0	BF	241	4
5510005519869	LUMBER SOFTWOOD DIM TRTD 1;2X10XRL	300.0	BF	804	4
5510007200567	LUMBER SOFTWOOD DIM 2 COM 2X2XRL	17.0	BF	46	4
5610002504676	CEMENT PORT GEN CONC CONSTR 94LB	61.0	BG	5734	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	1417.0	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	1193.5	CD	0	4
561000Z010003	MINERAL FILLER,LOCAL PROCUREMENT	532.0	CD	0	4
5680002671669	STEEL BAR REINFORCING 3/4 IN DIA	12.0	LG	361	4
8030002430948	CALKING COMPOUND,GUN GREY GAL CAN	1.0	GL	15	4
804000Z020001	HYPALON LINER ADHESIVE	0.5	GL	4	4
933000Z020001	LINER BLANKET 15000 SF HYPALON	0.1	EA	375	4
4710002731041	PIPE CULV NEST STL 2SECT 1FTX25.5IN	2.0	EA	48	9
4710005548695	PIPE, PLASTIC, 1.25 IN. 100 FT LONG	0.3	CL	8	9
4730000825975	TEES NYLON FOR 1.25 N PLASTIC PIPE	1.0	EA	0	9
4730009083193	CLAMP,HOSE,2.0-1.063IN,PL-FLX HOSE	4.0	EA	0	9
5306004129797	BOLT LAG 1/2IN DIA X 6IN LONG	17.0	EA	7	9
5315001619839	STAPLE WIRE CLOTH 7/32W X 7/16IN LG	0.1	LB	0	9
5315001645126	NAIL COMMON 3D	0.1	BX	1	9
5315007533886	NAIL COMMON 20D	8.0	LB	8	9
5315008892735	NAIL CORR ROOF/WASH 2IN	1.0	BX	2	9
5335002289207	WIRE FABRIC 3X100FT.RO .453IN MESH	0.5	RO	43	9
5340002349521	LATCH THUMB 12 INCH LONG LATCH BAR	1.0	EA	4	9
5340002402593	HINGE TEE 4IN	1.0	PR	1	9
9515002365495	STEEL SHEET CARBON .0276X48X96INGLV	0.3	SH	16	9
9515008119184	STEEL SHEET CORRUG 26X108X28 GAGE	3.0	SH	61	9
4730010436734	ADAPTER, STRAIGHT, 1.25 IN PLASTIC	1.0	EA	0	

Representative Bills of Materials for Base Development Tasks

Ammunition storage construction -- 5040 STON capacity

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
85210BR	Hardstand prep 1000 SY SWA & NEA	11.2
85130LC	1-lane road prep 1 mile SWA & NEA	7.0
85130FW	2-lane road prep 1 mile SWA & NEA	5.0
85110BN	Road surface 1 mile	7.0
85110AT	2-lane road paving 1 mile	5.0

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
0	923459	0	78540	1001999	34804.0

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
4710002731037	PIPE CULV NEST STL 2SECT 3FTX25.5IN	2994.0	EA	329340	4
4710002731038	PIPE CULV NEST STL 2SECT 4FTX25.5IN	3531.6	EA	505019	4
4710002731039	PIPE CULV NEST STL 2SECT 2FTX25.5IN	1650.0	EA	89100	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	15664.0	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	13225.0	CD	0	4
561000Z010003	MINERAL FILLER,LOCAL PROCUREMENT	5915.0	CD	0	4
4710002731042	PIPE CULV NEST STL 2SECT 1.5X25.5IN	2310.0	EA	78540	9

Refrigerated storage construction -- 4000 CF (Labor Only)

POL storage construction -- 400000 gal TPT and 120000 gal Inland Storage

TPT FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
12510AB	Switch Manifold (6in w/o pump)	2
12510AE	FLOOD PMP 785 BPH 6IN MANIFOLD	2
12510AH	TANK PMP POL 700 BPH W/6 IN MANIFD	2
12510AN	TRANS PMP POL 700 BPH W/6 IN MNFD	2
12510AU	Lightweight tubing (1000 ft w/6 in dia)	1
12510BJ	API pipe (1000 ft w/6 in diameter)	1
12510DG	P/L SET 6IN ALUM W/CLMP COUP 1000FT	2
12530AK	Tank Pump (2800 BPH)	1
12665BB	TPT TANK FARM MODULE, 10MBBL CAP	2
41180BC	FUEL/WATER STOR 10,000 GAL FAB BAG	1
41180BD	FUEL/WATER STOR 50,000 GAL FAB BAG	7
61050YA	Hardstand (350 SY) and Facility (800 SF)	1
87210AR	Security fence	1
87210AT	Security gate	1

Inland Storage FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
12640BA	Fuel Sys Sup Pt (120000 gal)	1

TPT MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
50811	43128	55087	78743	227769	295.6

Inland Storage MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
66	6129	10740	15628	32563	0.0

Representative Bills of Materials for Base Development Tasks

TPT

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
3439002622671	ELECTRODE WELDING 1/8" F/STEEL	10.0	CO	500	2
3835006634679	VALVE SECTION PLUG 500PSI 4INX3FT	1.0	EA	138	2
3835006637339	VALVE SECTION PLUG 500PSI 6INX3FT	100.0	EA	40100	2
4210009651108	EXTINGUISHER FIRE DRY CHEM 20LB CAP	21.0	EA	819	2
4710002030183	TUBE STEEL 6.625X 20FT GROOVED ENDS	50.0	LG	8850	2
4710002030186	TUBE STEEL 4.5IN X 20FT GROOVD ENDS	5.0	LG	353	2
4730002027201	CAP PIPE MALL IRON ENAMELED 4 IN	1.0	EA	3	2
6675005145575	POLE RANGE 2SEC 6.5FT	8.0	EA	48	2
401000Z640032	INTERLACING WIRE, 10 GAGE	5.6	RO	6	4
471000Z430269	PIPE ASSAULT ALUM MOD SG 6INX19FT	108.0	LG	11770	4
472000Z430271	HOSE ASSY, DISCH, 6IN X 50FT BOLTON	20.0	EA	3500	4
472000Z430294	HOSE ASSY, SUCT, 6IN X 12FT BOLTON	38.0	EA	2090	4
4730002736324	TEE PIPE MALL IRON 4 IN	1.0	EA	12	4
4730002738313	ELBOW PIPE MALL IRN 6IN X 45 DEG	76.0	EA	912	4
4730002738359	ELBOW PIPE,IRON,90 DEGREE/6"	110.0	EA	2008	4
4730002937110	TEE PIPE MALL IRN 6IN X 6IN X 6IN	230.0	EA	5980	4
473000Z430059	COUPLING CLAMP,PIPE,6IN.	80.0	EA	1920	4
473000Z430272	COUPLING, CLAMP, 6IN, MOD SGL GRV	108.0	EA	2592	4
482000Z430044	VALVE ASSY.,GATE,6IN.	14.0	EA	3500	4
5315001619862	STAPLE FENCE 1-1/2L	70.0	LB	72	4
5315007533885	NAIL COMMON 3.5 IN 16D	11.0	PG	55	4
5510002206194	LUMBER,SOFTWOOD DIM 2X4XRL	72.0	BF	180	4
5510005519659	LUMBER SOFTWOOD DIM TRTD 4X4X12 FT	2263.0	BF	6065	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	270.0	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	18.0	CD	0	4
561000Z010003	MINERAL FILLER,LOCAL PROCUREMENT	7.6	CD	0	4
5660002248663	BARBED WIRE 2 STRAND 100LB SPOOLS	18.0	SL	1900	4
5660002646655	POST, FENCE, RND, MTL, 2", 12 FT	2.0	EA	70	4
5660002697803	WIRE, FENCE, GALV, 7 FT, 2" MESH	0.1	RO	32	4
5660007204530	WIRE, FENCE, STL, 10 FT, 2" MESH	0.3	RL	106	4
5660009131527	BAND, TENSION, 3"	16.0	EA	5	4
5660009695266	BAND, TENSION, 4" POST	16.0	EA	8	4
566000Z640002	CLAMPS, TRUSS WIRE	8.0	EA	8	4
566000Z640003	GATE CORNER CONNECTORS, 2"	8.0	EA	8	4
566000Z640004	CAP, GATE POST, 4"	2.0	EA	2	4
566000Z640005	GATE HINGE ASSEMBLY, 4"	2.0	EA	4	4
566000Z640006	GATE LATCH ASSEMBLY, 4" & 2"	1.0	EA	2	4
566000Z640007	GATE KEEPER ASSEMBLY	1.0	EA	2	4
566000Z640009	CAP, GATE POST, 3"	2.0	EA	4	4
566000Z640010	GATE HINGE ASSEMBLY, 3"	2.0	EA	4	4
566000Z640011	GATE LATCH ASSEMBLY, 3" & 2"	1.0	EA	3	4
566000Z640020	POST, FENCE, RND, GALV, 3", 13 FT	2.0	EA	100	4
566000Z640021	BRACE RAIL CLAMPS & BOLTS, 2.5"	12.0	EA	12	4
566000Z640022	STRETCHER BAR, 10', GALV STEEL	4.0	EA	12	4
566000Z640023	10' SCH 40 2.5" DIA GALV STL BRACE	4.0	EA	4	4
566000Z640024	2.5" 3 FOOT STEEL BRACE	2.0	EA	2	4
5660010159800	POST, FENCE, MTL, 4", 13 FT LNGTH	2.0	EA	52	4
5660012486719	POST, FENCE, MTL, 2", 6 FT LNGTH	1.0	EA	25	4
5660012502947	POST, FENCE, METAL, 2", 10 FT LNGTH	4.0	EA	91	4
5660012644767	TIE WIRES, FENCE FAB, ALUM 9 GA.	0.2	PG	10	4
4320002030862	PUMP CENTRIF GASO 1120GPM @ 100FTHD	8.0	EA	36768	7
4320011933429	PUMP UNIT,CENTRIFUG	2.0	EA	4000	7
5430000523412	TANK FABRIC COLLAPSIBLE 10000 GAL	1.0	EA	309	7
5430001828181	TANK FAB.COLLAP.50000 GAL.PETROLEUM	7.0	EA	10010	7
5430011603528	TANK FAB PETRO 5000 B	4.0	EA	4000	7
3835006417487	VALVE SECTION CHECK 6 INCH CLAS 250	6.0	EA	2298	9
4010002728794	WIRE ROPE STEEL 3/8 IN X 600 FT	0.2	RL	29	9
4710001621019	PIPE STEEL GALV 3/4INX16-22FT THDS	20.0	FT	23	9

Representative Bills of Materials for Base Development Tasks

4710001621021	PIPE STEEL GALV 1.25INX16-22FT THD	5.0	FT	11	9
4710002027905	PIPE,STEEL 6IN.X20FT GROOVED ENDS	94.0	LG	35720	9
4710002027906	PIPE STEEL 4IN X 20FT GROOVED ENDS	5.0	LG	1096	9
4710002731042	PIPE CULV NEST STL 2SECT 1.5X25.5IN	160.0	EA	5440	9
4710004765870	PIPE PVC DWV SCHEDULE 40 2 INCH	96.0	FT	66	9
4720005950078	HOSE ASSY RUBBER 3/4"X24" 500PSI	2.0	EA	8	9
4730001421590	COUPLING CLAMP PIPE F/ 4IN GRVD END	13.0	EA	88	9
4730001878761	NIPPLE PIPE STL 3/4IN X 2IN XTRSTRG	4.0	EA	1	9
4730001892628	UNION PIPE IRN/STL GALV 1.25IN FMLE	1.0	EA	1	9
4730001960835	BUSHING PIPE MI BLK 1-1/4X3/4 IN.	2.0	EA	1	9
4730002026738	CLAMP LEAK RPR PIPE CPL 4IN NOM SZE	1.0	EA	70	9
4730002026739	CLAMP LEAK RPR PIPE CPL 6IN NOM SZE	14.0	EA	1284	9
4730002029509	REDUCER,PIPE,6"X4",MALL IRON	4.0	EA	26	9
4730002213910	ELBOW PIPE GALV 1.25INX 90DEG CASTI	2.0	EA	1	9
4730002635269	TEE PIPE MALL IRON 1.25 IN	1.0	EA	1	9
4730002738322	ELBOW PIPE MALL IRN 4IN X 90 DEG	1.0	EA	8	9
4730002778787	BUSHING PIPE STEEL 1.25IN X 1IN	2.0	EA	2	9
4730002783597	ELBOW PIPE MALL IRON 3/4IN X 90 DEG	8.0	EA	7	9
4730002889514	CLAMP COUPLING FOR 6IN GROOVED PIPE	1103.0	EA	14339	9
4730012104559	COUPLING ADAP ASSY 6 IN FEM CLXDG	4.0	EA	39	9
4730012105628	TEE, 6X6X6 IN ALUM DBL GRV 150 PSI	6.0	EA	90	9
4730012226704	COUPLING HALF, 6 IN MAL CLXDBL GRV	4.0	EA	20	9
4820005410371	VALVE GLOBE F.A.60CFM-100-85	2.0	EA	32	9
4820005951847	VALVE GATE CI SCR 2 IN CLASS 125	8.0	EA	272	9
4820008138518	VALVE GATE BRZ SCREW 1.25IN 300PSI	1.0	EA	6	9
5330001414225	PACKING PREFORMED SYN RUBBER	13.0	EA	5	9
5340001880330	TURNBUCKLE, STL, 3/8" X 12" C&C	4.0	EA	4	9
5340002402593	HINGE TEE 4IN	2.0	PR	1	9
5340002918236	HINGE TEE WROUGHT STL LEAVES 6IN LG	1.5	PR	1	9
3835006417488	VALVE SECTION GTE 500PSI 6INX3FT LG	26.0	EA	16510	
3835006934508	VALVE ASSEMBLY PRESSUR RELIEF 1/2IN	8.0	EA	60	
4730002738610	CAP PIPE MALL IRON ENAMELED 6 IN	80.0	EA	560	
4730008254031	BUSHING PIPE STEEL 1IN X 3/4IN	2.0	EA	0	
4820002898182	VALVE SAFETY RELIEF 1/2 IN 600PSI	2.0	EA	3	
5610002504677	PORTLAND CEMENT, HIGH EARLY STRNTH	6.6	BG	620	

INLAND STORAGE

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
4930010137590	ADAPTER ASSEMBLY,WATER DETECTOR KI	6.0	EA	66	2
471000Z430218	PIPE CULV NEST TYPII 2SEC 12X25.5IN	10.0	EA	241	4
473000Z430007	TEE ASSY. 4IN. MXMXF CAM LOCK	23.0	EA	1150	4
473000Z430059	COUPLING CLAMP,PIPE,6IN.	1.0	EA	24	4
473000Z430098	TEE ASSY.,4IN.,MXFXF,CAM LOCKING	14.0	EA	700	4
473000Z430215	REDUCER, 4IN FEM X 2IN MALE, CM LCK	9.0	EA	27	4
473000Z430216	REDUCER, 2IN FEM X 1.5IN MAL CM LCK	9.0	EA	18	4
473000Z430299	ADAPTOR, MOD SGL GRV TO DBL GRV 6IN	1.0	EA	6	4
473000Z430300	REDUCER, 1-1/2IN CL TO 1IN MAL NPT	6.0	EA	11	4
482000Z430217	VALVE, PRESS CTRL 1.5IN CM LCK 5PSI	9.0	EA	900	4
482000Z430301	VALVE ASSY, BALL, 4IN, CAMLOCK, FXF	12.0	EA	2100	4
543000Z430065	TANK COLLAPSIBLE 20 KGAL.	4.0	EA	616	4
543000Z430066	TANK COLLAPSIBLE 10 KGAL.	4.0	EA	336	4
4320000698494	PUMP ASSEMBLY,FLAMBL LIQ BULK TRANS	6.0	EA	7080	7
4330001778485	FILT SEP,LIQUID FUEL 350 GPM	6.0	EA	3660	7
3835012105630	WYE ASSY PIPELINE 4IN CAMLOCK MXMXF	7.0	EA	140	9
4720000830046	HOSE ASSBLY RUB 4IN IDX50FT 360PSI	52.0	EA	10400	9
4720005558325	HOSE ASSEMBLY, RUBBER, REINFORCED	9.0	EA	306	9
4720007271339	HOSE ASSY SUCT 4 IN X 12 FT CAM LOC	50.0	EA	2400	9
4720012264826	HOSE ASSY DISCH 4 IN X 25 FT	11.0	EA	792	9
4730006406156	CAP,QUICK DISCONNECT ALUMINUM ALLOY	7.0	EA	14	9
4730006406188	PLUG HOSE ALUM QUICK COUPLG 4IN DIA	6.0	EA	30	9

Representative Bills of Materials for Base Development Tasks

4730009513293	COUPLING HALF QK DISCONN 4FX3M ALUM	12.0	EA	36	9
4730010798234	REDUCER,QUICK DISCONNECT	1.0	EA	7	9
4730012105626	COUPLING WYE ASSY 4" CAM LOCK FXFXM	7.0	EA	140	9
4730012226704	COUPLING HALF, 6 IN MAL CLXDBL GRV	1.0	EA	5	9
4820012105605	VALVE ASSY, GATE 4 IN CAM LOCKING	27.0	EA	1080	9
4820012105615	VALVE ASSY, BALL, 1.5 IN CAMLOCK	12.0	EA	240	9
4930009024642	NOZZLE FUEL AND OIL SERVICING 1 IN	6.0	EA	36	9
5310006122414	WASHER FLAT RUBBER 2"I.D. 2-5/8"OD	2.0	EA	0	9
5330000889166	GASKET, 3 IN RUBBER	6.0	EA	1	9
5330008994509	GASKET,4IN ID X 5IN OD	8.0	EA	0	9
5999009130422	CLAMP, ELEC GROUND FOR .750 IN ROD	5.0	EA	1	

EPW camp -- 2000 person

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
87220AA	Guard tower	7
87190AA	Site preparation 1 acre	30
85210AG	1000 SY hardstand	6
85130JR	1-mile road	2
87210CE	1000 ft fence	4
87210AD	1000 ft barbed tape	18
87210CR	Personnel gate	28
87210CF	Vehicle gate	12
81240CG	Electrical distribution	1
81230AH	Personnel light	30

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB
2801	251589	9510	20840	285327

Local CY
28.0

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
4030001719014	ROD ANCHOR STL GALV 3/4IN X 9FT	28.0	EA	356	2
4030001849830	SHACKLE STEEL 2-7/8 IN LENGTH	36.0	EA	441	2
4030002422673	ANCHOR EXP STL 70 SQ IN FOR .75 ROD	28.0	EA	133	2
4030002975873	GUY ATTACH THRU BOLT TYPE 11/16HOLE	61.0	EA	12	2
4030008649037	CLAMP GUY 3-BOLT 3/8 OR 7/16 IN STR	122.0	EA	275	2
4030009065868	GROUND WIRE MOULDING TRTD WD 10 FT	30.0	EA	36	2
6230004239562	FLOODLIGHT ELEC GLASS REFL	129.0	EA	1548	2
4710002731037	PIPE CULV NEST STL 2SECT 3FTX25.5IN	44.0	EA	4840	4
4710002731038	PIPE CULV NEST STL 2SECT 4FTX25.5IN	328.0	EA	46904	4
4710002731039	PIPE CULV NEST STL 2SECT 2FTX25.5IN	22.0	EA	1188	4
5306004129789	BOLT LAG,.50WD,4IN,GALV	71.0	EA	23	4
5315000104659	NAIL COMMON WIRE STEEL 8D	0.7	BX	35	4
5315006647034	STAPLE CABLE 3/8 IN SPREAD 1 IN LG	4.6	BX	2	4
5315007533881	NAIL COMMON 2 IN 6D	0.3	PG	2	4
5315007533883	NAIL COMMON 3 IN 10D	0.7	PG	4	4
5315007533885	NAIL COMMON 3.5 IN 16D	0.7	PG	4	4
5510001612912	POLE WOOD PRESSURE TRTD 35 FT CL 6	12.0	EA	7800	4
5510001613302	POLE WOOD PRESSURE TRTD 45 FT CL 4	2.0	EA	2520	4
5510002206080	LUMBER SOFTWOOD BD 2 COM 1X6XRL	973.0	BF	2608	4
5510002206178	LUMBER SOFTWOOD DIM 2 COM 4X4XRL	560.0	BF	1501	4
5510002206194	LUMBER,SOFTWOOD DIM 2X4XRL	1253.0	BF	3132	4
5510002206196	LUMBER SOFTWOOD DIM 2 COM 2X6XRL	5712.0	BF	15308	4
5510002206202	LUMBER SOFTWOOD DIM 2 COM 2X12XRL	2604.0	BF	6979	4
5510005506825	LUMBER SOFTWOOD TIMBER 6X6XRL	2604.0	BF	6979	4
5510009838815	POLE WOOD PRESSURE TRTD 25 FT CL 6	9.0	EA	3330	4
5510009838817	POLE WOOD PRESSURE TRTD 35 FT CL 4	6.0	EA	5250	4
5510009885250	CROSSARM WD 11/16HOLES 3.75X4.75X96	20.0	EA	760	4
5610002504677	PORTLAND CEMENT, HIGH EARLY STRNTH	208.0	BG	19552	4
5610009264548	ASPHALT,PETROLEUM PAVING	27.0	DR	12150	4

Representative Bills of Materials for Base Development Tasks

561000Z010001	AGGREGATE COARSE LOCAL PROCURE	12.4	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	15.6	CD	0	4
5650005144474	ROOFING FELT 108 SQUARE FEET 45 LBS	10.5	RO	494	4
5660002248663	BARBED WIRE 2 STRAND 100LB SPOOLS	37.8	SL	3990	4
5660002646655	POST, FENCE, RND, MTL, 2", 12 FT	84.0	EA	2940	4
5660007295536	WIRE, FENCE, STL, 6 FT, 2" MESH	1.2	RO	288	4
5660009131527	BAND, TENSION, 3"	784.0	EA	235	4
5660009215516	BARBED TAPE CONCERTINA 37.5-50FTLG	1468.0	RL	55050	4
566000Z640001	BRACE RAIL CLAMPS & BOLTS, 2"	160.0	EA	160	4
566000Z640002	CLAMPS, TRUSS WIRE	12.0	EA	12	4
566000Z640003	GATE CORNER CONNECTORS, 2"	160.0	EA	160	4
566000Z640009	CAP, GATE POST, 3"	48.0	EA	96	4
566000Z640010	GATE HINGE ASSEMBLY, 3"	80.0	EA	160	4
566000Z640011	GATE LATCH ASSEMBLY, 3" & 2"	52.0	EA	156	4
566000Z640014	3' DBL ARM ASSY, 2" POST, 12-STR	808.0	EA	32320	4
566000Z640023	10' SCH 40 2.5" DIA GALV STL BRACE	48.0	EA	48	4
5660012476381	POST, FENCE, GALV, 3", 10 FT LNGTH	24.0	EA	1320	4
5660012486719	POST, FENCE, MTL, 2", 6 FT LNGTH	36.0	EA	882	4
5660012502947	POST, FENCE, METAL, 2", 10 FT LNGTH	516.0	EA	11765	4
5660012644767	TIE WIRES, FENCE FAB, ALUM 9 GA.	12.6	PG	612	4
614500Z190607	WIRE,COPPER,1/C#1 AWG RHW	64.0	LF	24	4
614500Z190611	WIRE,COPPER,1/C350 MCM AWG RHW	4.0	LF	6	4
6115001181241	GEN,DSL,15KW 3PH 208Y/120-416Y/240V	3.0	EA	9510	7
4010002212709	WIRE STRAND STEEL 3/8IN GALV 2500FT	4.9	RL	6664	9
4010002728794	WIRE ROPE STEEL 3/8 IN X 600 FT	26.8	RL	3859	9
4710002731042	PIPE CULV NEST STL 2SECT 1.5X25.5IN	110.0	EA	3740	9
4730001877613	COUPLING PIPE MALL IRN 3/4IN STD WT	12.0	EA	3	9
5306000891422	BOLT,SQ NECK,.375-16UNC,4.531IN,STL	40.0	EA	6	9
5306002400819	BOLT EYE,.750-10UNC,4IN,STL	72.0	EA	150	9
5306002637677	BOLT MACH,.625-11UNC,5.062IN W/NUT	12.0	EA	7	9
5306002739373	ROD,CONT.THRD,.625-11UNC,20IN,GALV	30.0	EA	90	9
5306002813721	BOLT MACH,.625-11UNC,12IN W/NUT,GAL	222.0	EA	251	9
5306002813722	BOLT MACH,.625-11UNC,14IN W/NUT,GAL	49.0	EA	64	9
5306005503697	BOLT MACHINE 3/4 X 12 IN W/NUT	238.0	EA	400	9
5306008659573	BOLT MACHINE 1/2 X 5 IN W/NUT	12.0	EA	4	9
5310001973334	WASHER FLAT SQ 3.00"X.2500X.81250ID	145.0	EA	84	9
5310002366478	WASHER FLAT CAD.STL.13/16ID 2"OD	490.0	EA	15	9
5310002749021	NUT EYE STEEL THD 5/8 EYE7/8X1-1/2	36.0	EA	7	9
5310005284185	WASHER FLAT SQ 2.25"X.1875X.81250ID	360.0	EA	810	9
5310007638920	NUT PLAIN HEX 5/8-11 UNC 2B	196.0	EA	24	9
5310008093079	WASHER FLAT FOR 1/2 IN BOLT	0.6	PG	6	9
5310009519564	NUT SELF LOCKING HEX 5/8-11 THREAD	306.0	EA	43	9
5315001619859	STAPLE,FENCE	14.0	LB	14	9
5315007533886	NAIL COMMON 20D	35.0	LB	36	9
5340001880330	TURNBUCKLE, STL, 3/8" X 12" C&C	80.0	EA	83	9
5340002402593	HINGE TEE 4IN	7.0	PR	4	9
5340002433224	HOOK AND EYE DOOR STEEL 3 INCH	13.0	EA	1	9
5340002465190	HINGE BUTT STEEL LEAVES 2IN X2-3/16	6.0	PR	4	9
5340002811444	STRAP RTNG 3/4 IN HVY WALL STL CND	90.0	EA	10	9
5340002918236	HINGE TEE WROUGHT STL LEAVES 6IN LG	7.0	PR	4	9
5925009999320	LOAD CENTER RAINTIGHT W/2-20A BRKRS	30.0	EA	330	9
5930006605584	SWITCH,SPST,20A 125V,TOGGLE	9.0	EA	0	9
5940002287912	CONN SPLITBOLT NO. 8 OR 6 AWG 10/PG	69.0	PG	1	9
5940002399033	CONNECTOR SPLITBOLT NO. 0000 AWG CU	110.0	EA	11	9
5940009144510	SPLICE CONDUCTOR UNINSULATED 500MC	36.0	EA	47	9
5940009161006	CONN GRVD CLAMP NO. 6 AWG TO 00 AWG	241.0	EA	121	9
5970002636885	INSULATOR PIN PORCELAIN MEDIUM VOLT	36.0	EA	84	9
5970002845450	INSULATOR ASSY W/4 SPOOL TYPE INSUL	30.0	EA	480	9
5970002845451	INSULATOR ASSY,3-WIRE A7 SPLS W/R	48.0	AY	48	9
5970004194291	TAPE ELECTRIC PLASTIC 3/4 INCH WIDE	33.0	RO	14	9

Representative Bills of Materials for Base Development Tasks

5970007687516	INSULATOR SUSPEN PORC STYLE P2 BRW	96.0	EA	1133	9
5975000564377	BRACE CROSSARM WD DBL ARM TYPE 30IN	40.0	EA	280	9
5975001328288	PIN INSULATOR STEEL FOR WD CROSSAR	24.0	EA	45	9
5975001521094	BUSHING 3/4 IN HVY WALL STL CONDUIT	30.0	EA	1	9
5975002286004	CONDUIT 3/4 INCH RIGID HVY WALL STL	60.0	LG	129	9
5975002803743	ENTRANCE CAP .75 IN HVY STL CONDUIT	30.0	EA	18	9
5975002810090	JCT BOX RECT SFC MTD FOR SW OR RECP	9.0	EA	0	9
5975002965324	ROD GROUND CWLD 5/8IN X 8FT W/CLAMP	30.0	EA	19	9
5975005014924	COVER BOX STL SFC MTD TOGGLE SWITC	9.0	EA	1	9
5975005078882	BRACE CROSSARM WD 60" SPAN 18" DROP	6.0	PR	56	9
5975005078884	PIN INSUL STEEL CROSSARM CLAMP TYPE	12.0	EA	61	9
5975006427261	LOCKNUT 3/4 INCH HVY STL CND 50/PG	3.0	PG	4	9
5975008648232	PIN INSUL STEEL POLE TOP 15" FLG CH	12.0	EA	34	9
5975008784868	GROUND ROD 3/4INX10FT STL W/CU COAT	30.0	EA	150	9
5975009021420	CLAMP STRAIN ENV TYPE F/CU CONDUCTR	48.0	EA	60	9
6145002994456	CABLE 1/C #6 AWG 7-STR CU BARE MHD	1280.0	FT	102	9
6145002996213	CABLE 1/C #2 AWG 7-STR CU BARE MHD	1110.0	FT	1110	9
6145005192718	CABLE 2/C&GND 12 AWG SOL CU NMC TTJ	216.0	FT	19	9
6240001863229	LAMP INCANDESCENT 120V 500W MOGUL	129.0	EA	99	9
3940002022206	BLOCK AND TACKLE 3/8 IN ROPE/500 LB	7.0	EA	4	
5306004988025	BOLT MACH,.750-10UNC,14.14IN,STL CA	14.0	EA	64	
6145001439798	WIRE WP NO 8 7-STR CU POLYETHYLENE	6000.0	FT	420	
6145001979001	WIRE WP NO 12 SOLID CU POLYETHYLENE	3300.0	FT	99	

ADA site construction - Hawk ADA unit

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
87210AY	Concertina wire 300 ft	33.3
81240GB	Elec distribution 1 mile	0.5
72321CB	Latrine	5
85130GP	Road 1 mile	1
14910GA	Earthen revetment	5
61050YA	Hardstand 1000 SY	5
87190AA	Site preparation 1 acre	15

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB
71	92636	0	2779	95511

Local CY
222.0

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
4030001719014	ROD ANCHOR STL GALV 3/4IN X 9FT	4.0	EA	51	2
4030002422673	ANCHOR EXP STL 70 SQ IN FOR .75 ROD	4.0	EA	19	2
4030002975873	GUY ATTACH THRU BOLT TYPE 11/16HOLE	4.0	EA	1	2
4030008649037	CLAMP GUY 3-BOLT 3/8 OR 7/16 IN STR	8.0	EA	18	2
4710002731037	PIPE CULV NEST STL 2SECT 3FTX25.5IN	10.0	EA	1100	4
4710002731039	PIPE CULV NEST STL 2SECT 2FTX25.5IN	5.0	EA	270	4
5306004129789	BOLT LAG,.50WD,4IN,GALV	4.0	EA	1	4
5315006647034	STAPLE CABLE 3/8 IN SPREAD 1 IN LG	0.4	BX	0	4
5315007533881	NAIL COMMON 2 IN 6D	0.1	PG	1	4
5315007533884	NAIL COMMON 3.25 IN 12D	366.3	PG	1831	4
5315007533885	NAIL COMMON 3.5 IN 16D	366.3	PG	1831	4
541000Z520202	PREFAB PORTABLE LATRINE	5.0	EA	1150	4
5510001612912	POLE WOOD PRESSURE TRTD 35 FT CL 6	0.5	EA	325	4
5510001613301	POLE WOOD PRESSURE TRTD 40 FT CL 4	0.5	EA	532	4
5510001613319	POLE WOOD PRESSURE TRTD 40 FT CL 5	0.5	EA	463	4
5510002206194	LUMBER,SOFTWOOD DIM 2X4XRL	24442.2	BF	61105	4
5510009838817	POLE WOOD PRESSURE TRTD 35 FT CL 4	17.5	EA	15312	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	100.0	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	84.0	CD	0	4

Representative Bills of Materials for Base Development Tasks

561000Z010003	MINERAL FILLER,LOCAL PROCUREMENT	38.0	CD	0	4
5660002248663	BARBED WIRE 2 STRAND 100LB SPOOLS	33.3	SL	3515	4
5680005332731	MEMBRANE SURFACING 53 FT X 66 FT	6.5	EA	5200	4
4010002212709	WIRE STRAND STEEL 3/8IN GALV 2500FT	0.4	RL	544	9
4710001621019	PIPE STEEL GALV 3/4INX16-22FT THDS	20.0	FT	23	9
4710002731042	PIPE CULV NEST STL 2SECT 1.5X25.5IN	25.0	EA	850	9
5306002739373	ROD,CONT.THRD,.625-11UNC,20IN,GALV	35.0	EA	105	9
5306002813722	BOLT MACH,.625-11UNC,14IN W/NUT,GAL	4.0	EA	5	9
5306009640964	BOLT MACHINE 5/8 X 6 IN 1-1/2IN THD	5.0	EA	3	9
5310001973334	WASHER FLAT SQ 3.00"X.2500X.81250ID	4.0	EA	2	9
5310002366478	WASHER FLAT CAD.STL.13/16ID 2"OD	80.0	EA	2	9
5310007638920	NUT PLAIN HEX 5/8-11 UNC 2B	16.0	EA	2	9
5310009517209	WASHER FLAT 11/16 ID 1-3/4 OD	0.1	HD	1	9
5310009519564	NUT SELF LOCKING HEX 5/8-11 THREAD	8.0	EA	1	9
5315001619859	STAPLE,FENCE	0.5	LB	1	9
5920002348192	FUSE LINK 50 A FOR 15KV MAX CUTOUT	3.0	EA	2	9
5920002504731	FUSE CUTOUT 5 KV 50 A CROSSARM MTG	1.5	EA	37	9
5940002399033	CONNECTOR SPLITBOLT NO. 0000 AWG CU	8.0	EA	1	9
5940008657528	CONNECTOR SPLITBOLT NO. 4 AWG 5/PKG	1.5	PG	1	9
5940009161006	CONN GRVD CLAMP NO. 6 AWG TO 00 AWG	4.0	EA	2	9
5970002636890	INSULATOR STRAIN CLEVIS PRIMARY	4.0	EA	20	9
5999004965834	CLAMP ELECT,2-3/8X3/4X2-1/8IN	2.0	EA	1	9
6145002994455	CABLE 1/C #4 AWG 7-STR CU BARE MHD	1050.0	FT	1050	9
6145002994456	CABLE 1/C #6 AWG 7-STR CU BARE MHD	80.0	FT	6	9
6145002996213	CABLE 1/C #2 AWG 7-STR CU BARE MHD	120.0	FT	120	9
5306005503720	BOLT MACHINE 5/8 X 18IN W/1-3/4 THD	4.0	EA	7	

DEPMED construction -- 500 bed

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
72321CB	Latrine	10
85210BF	Hardstand 1000 SY	2
85130FK	Class B road 1 mile	1
84330AC	Fire Protection Sump 10000 gal	1
87190AA	Site preparation 1 acre	15
81240BA	Elec distribution 500 bed	1
84210AU	Water distribution 500 bed	1

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
1327	124108	0	17214	145320	24.3

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
4030008649037	CLAMP GUY 3-BOLT 3/8 OR 7/16 IN STR	590.0	EA	1327	2
4710002731037	PIPE CULV NEST STL 2SECT 3FTX25.5IN	124.0	EA	13640	4
4710002731038	PIPE CULV NEST STL 2SECT 4FTX25.5IN	401.0	EA	57343	4
4710002731039	PIPE CULV NEST STL 2SECT 2FTX25.5IN	124.0	EA	6696	4
471000Z400003	PIPE; PVC SCH 40 6IN FT	200.0	FT	120	4
471000Z520108	ELBOW PVC SCH 40 90 DEG 2IN SXS	15.0	EA	6	4
471000Z520109	ELBOW PVC SCH 40 90 DEG 4IN SXS	17.0	EA	32	4
471000Z520114	TEE PVC SCH 40 2IN SXSXS	3.0	EA	1	4
471000Z520122	COUPLING PVC 2 IN SXS	48.0	EA	8	4
471000Z520126	SOLVENT CEMENT	30.7	EA	31	4
471000Z650007	PVC CLEANER PRIMER	30.7	QT	31	4
473000Z190539	ELBOW PVC 90DEG 6IN DIA	2.0	EA	7	4
473000Z190576	REDUCER 6X4 IN,SCH40,PVC	5.0	EA	12	4
473000Z190577	TEE PVC 6IN X 6IN	2.0	EA	10	4
473000Z230109	INCREASER, 2INX6IN PVC	2.0	EA	2	4
473000Z400007	BEND PVC SCH40 45DEG. 6IN	4.0	EA	18	4
473000Z400016	COUPLING; PVC; SCH 40 4IN	102.0	EA	41	4

Representative Bills of Materials for Base Development Tasks

473000Z400017	COUPLING; PVC; SCH 40 6IN	12.0	EA	7	4
473000Z400019	REDUCER; PVC; SCH 40 4IN X 2IN	6.0	EA	4	4
473000Z650015	TEE REDUCING PVC SCH 40 4"X4"X1.25"	6.0	EA	14	4
473000Z650016	TEE REDUCING PVC SCH 40 4"X4"X.75"	3.0	EA	7	4
473000Z650017	TEE REDUCING PVC SCH 40 4"X4"X3"	3.0	EA	7	4
473000Z650018	TEE REDUCING PVC SCH 40 4"X4"X2"	15.0	EA	36	4
473000Z650019	ELBOW PVC SCH 40, 45 DEG 4" SXS	4.5	EA	4	4
473000Z650020	ELBOW PVC SCH 40, 45 DEG 2" SXS	4.0	EA	1	4
473000Z650026	TEE, REDUCING PVC SCH 40 2"X2"X.75"	1.0	EA	0	4
473000Z650044	TEE, REDUCING PVC SCH 40, 6"X6"X4"	6.0	EA	30	4
473000Z650069	REDUCER, PVC SCH 40, 4" X 3"	1.5	EA	1	4
541000Z520202	PREFAB PORTABLE LATRINE	10.0	EA	2300	4
5510002206178	LUMBER SOFTWOOD DIM 2 COM 4X4XRL	57.0	BF	153	4
5510009838815	POLE WOOD PRESSURE TRTD 25 FT CL 6	90.0	EA	33300	4
5610002504676	CEMENT PORT GEN CONC CONSTR 94LB	109.0	BG	10246	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	16.2	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	8.1	CD	0	4
3439010749983	SOLDER,LEAD ALLOY	9.0	SL	9	9
4010002212709	WIRE STRAND STEEL 3/8IN GALV 2500FT	0.9	RL	1224	9
4710001621019	PIPE STEEL GALV 3/4INX16-22FT THDS	40.0	FT	45	9
4710002731042	PIPE CULV NEST STL 2SECT 1.5X25.5IN	217.0	EA	7378	9
4710004765870	PIPE PVC DWV SCHEDULE 40 2 INCH	800.0	FT	552	9
4710004765876	PIPE PVC DWV SCHEDULE 40 4 INCH	1700.0	FT	3485	9
4730002479513	TEE,PIPE 4IN PVC SCH40	4.5	FT	4	9
5306002739373	ROD,CONT.THRD,.625-11UNC,20IN,GALV	300.0	EA	900	9
5306002813721	BOLT MACH,.625-11UNC,12IN W/NUT,GAL	360.0	EA	407	9
5306005503692	BOLT MACHINE 5/8 X 16 IN CHROM	12.0	EA	18	9
5310009517209	WASHER FLAT 11/16 ID 1-3/4 OD	0.1	HD	1	9
5925009297829	LOAD CTR PNL 120/240V W/4-20A BRKRS	2.0	EA	18	9
5925009999320	LOAD CENTER RAINTIGHT W/2-20A BRKRS	5.0	EA	55	9
5940002287912	CONN SPLITBOLT NO. 8 OR 6 AWG 10/PG	10.0	PG	0	9
5940002399029	CONNECTOR SPLITBOLT NO. 2 AWG 10/PG	81.0	PG	365	9
5940002399033	CONNECTOR SPLITBOLT NO. 0000 AWG CU	20.0	EA	2	9
5940008657528	CONNECTOR SPLITBOLT NO. 4 AWG 5/PKG	4.0	PG	1	9
5970002232518	INSULATOR SVCE DROP 1/C W/LAG SCREW	500.0	EA	390	9
5970002636891	INSULATOR STRAIN CLEVIS SECONDARY	360.0	EA	900	9
5970004194291	TAPE ELECTRIC PLASTIC 3/4 INCH WIDE	6.0	RO	3	9
5999004965834	CLAMP ELECT,2-3/8X3/4X2-1/8IN	4.0	EA	2	9
6145001912512	WIRE WP 4/0 7-STR CU POLYETHYLENE	200.0	FT	200	9
6145001990222	WIRE WP NO. 2 7-STR CU POLYETHYLENE	2400.0	FT	648	9
6145005191031	WIRE WP NO. 4 7-STR CU POLYETHYLENE	950.0	FT	190	9
6145009430728	CABLE 1/C #6 AWG 7-STR CU THW WHITE	2000.0	FT	20	9
6240009959901	LAMP 25W 115V EXPORT	640.0	EA	77	9
6250002839202	LAMPHOLDER PORC SFC W/SW	640.0	EA	320	9
4030002420019	ROD ANCHOR STL GALV .50IN X 72IN	73.0	EA	654	
6145001439798	WIRE WP NO 8 7-STR CU POLYETHYLENE	21400.0	FT	1498	
6145001979001	WIRE WP NO 12 SOLID CU POLYETHYLENE	17300.0	FT	519	

Representative Bills of Materials for Base Development Tasks

Dispensary/Clinic -- 20,000 nondivisional soldiers

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
87190AA	Site preparation 1 acre	6
93170AJ	BUILDING,RELMS,30X100X15	2
55020YC	1300 SY hardstand	2
72321CB	Latrine	9
93170AJ	BUILDING,RELMS,30X100X15	1
54010YA	110 SY hardstand	1

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
0	139459	0	594	140053	461.7

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
4710002731038	PIPE CULV NEST STL 2SECT 4FTX25.5IN	569.8	EA	81481	4
541000Z520202	PREFAB PORTABLE LATRINE	9.0	EA	2070	4
5450013393339	STEEL, COIL, GALVANIZED, 24" G-60	8.4	CL	42000	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	220.7	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	170.7	CD	0	4
561000Z010003	MINERAL FILLER,LOCAL PROCUREMENT	70.3	CD	0	4
5680002671666	STEEL BAR REINFORCING 3/8 IN DIA	1830.0	LG	13908	4
4710006399441	PIPE STEEL THREAD 3/4 X RL	420.0	FT	546	9
9520005961813	ANGLE, STRUCTUAL STEEL	960.0	FT	48	9
5305012764262	SCREW, SELF DRILLING #12 X 3/4"	6.0	HD	0	

Maintenance facility construction

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
21410AD	60'X60' maintenance interior	1
93170AY	BUILDING,RELMS,60X60X24	1
93191GG	1000 SF concrete floor	8.4
21410AH	60'X80' maintenance interior	1
93170BA	BUILDING,RELMS,60X80X18	1

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
380	140036	0	6913	147562	204.6

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
8135005796489	PLASTIC SHEET TRANSP 6 MIL 12X100FT	7.6	RO	380	2
5315006647034	STAPLE CABLE 3/8 IN SPREAD 1 IN LG	7.6	BX	4	4
5315007533881	NAIL COMMON 2 IN 6D	0.2	PG	1	4
5315007533883	NAIL COMMON 3 IN 10D	0.2	PG	1	4
5450013393339	STEEL, COIL, GALVANIZED, 24" G-60	10.6	CL	53000	4
5510002206194	LUMBER,SOFTWOOD DIM 2X4XRL	410.0	BF	1025	4
5510002729060	LUMBER SOFTWOOD BD 2 COM 1X3XRL	210.0	BF	563	4
5530001297833	PLYWOOD AC EXT 5-PLY 3/4X48X96 IN	13.0	SH	937	4
5610002504676	CEMENT PORT GEN CONC CONSTR 94LB	756.0	BG	71064	4
5610002744148	FILLER EXP JOINT BITUM 36INWX5FT LG	168.0	EA	84	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	137.2	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	67.4	CD	0	4
5680002671666	STEEL BAR REINFORCING 3/8 IN DIA	1720.0	LG	13072	4
592500Z550002	CB PNL 208V MB1-150A/3P BB42-20A/1P	2.0	EA	280	4
597000Z550003	BRKT W INSUL FOR 1-1/4 TO 2IN CND	8.0	EA	4	4
597500Z410027	LOCKNUT,CONDUIT 2IN	4.0	EA	1	4
4710006399441	PIPE STEEL THREAD 3/4 X RL	220.0	FT	286	9
5305006882350	SCREW MACHINE 0.216-24 UNC,3/8IN	500.0	EA	10	9
5306001451064	BOLT,LAG,.375WD,3IN,STL	0.4	BX	0	9
5335002629445	WIRE FABRIC WELDED 6X6 MESH 750SQFT	14.3	RO	4504	9
5340007404817	STRAP RTNG 2 IN CND/2.3-2.7IN OD CA	6.0	EA	1	9

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5930006605584	SWITCH,SPST,20A 125V,TOGGLE	28.0	EA	1	9
5935002545471	ELECT.RECP.120V-20A DUPLEX	60.0	EA	18	9
5940002403435	CONNECTOR SPLITBOLT 1/0 AWG	8.0	EA	7	9
5940002705852	SPLICE CONDUCTOR WIRENUT 10-16	3.6	HD	1	9
5970004194291	TAPE ELECTRIC PLASTIC 3/4 INCH WIDE	1.4	RO	1	9
5975001521081	WALL STL CND,90 DEG BEND 2.000 HVY	2.0	EA	8	9
5975001521094	BUSHING 3/4 IN HVY WALL STL CONDUIT	4.0	EA	0	9
5975001521100	BUSHING 2 INCH HVY WALL STL CONDUIT	2.0	EA	0	9
5975001521140	COUPLING 2INX2-1/8LG HVY WALL STL	4.0	EA	0	9
5975001521144	BOX CONN NMC 3/8 IN DIA TO 1/2IN KO	420.0	EA	71	9
5975001590969	OUTLET BOX,4X4"1/2"TO3/4"KNOCKOUT	74.0	EA	7	9
5975001881164	COVER BOX SFC MTD DUPLX RECEPTACLE	60.0	EA	15	9
5975002286004	CONDUIT 3/4 INCH RIGID HVY WALL STL	2.0	LG	4	9
5975002803747	ENTRANCE CAP 2.0 IN HVY STL CONDUIT	2.0	EA	11	9
5975002810057	COVER JUNCTION BOX 4IN SQ FLAT	56.0	EA	11	9
5975002810090	JCT BOX RECT SFC MTD FOR SW OR RECP	88.0	EA	1	9
5975002845970	CONDUIT 2 INCH RIGID HEAVY WALL STL	2.0	LG	64	9
5975005014924	COVER BOX STL SFC MTD TOGGLE SWITC	28.0	EA	4	9
5975005800392	ROD,GRND,W/COPPER COATING,3/4X120IN	2.0	EA	1	9
5975006427261	LOCKNUT 3/4 INCH HVY STL CND 50/PG	0.2	PG	0	9
6145002994456	CABLE 1/C #6 AWG 7-STR CU BARE MHD	40.0	FT	3	9
6145005191332	CABLE 3/C&GND 12 AWG SOL CU NMC TTJ	1960.0	FT	314	9
6145005192718	CABLE 2/C&GND 12 AWG SOL CU NMC TTJ	2600.0	FT	234	9
6145009394951	CABLE 1/C 1/0AWG19-STR CU THW BLACK	60.0	FT	30	9
6145012046473	CABLE 1/C 1/0AWG19-STR CU THW BLUE	60.0	FT	30	9
6145012046477	CABLE 1/C 1/0AWG19-STR CU THW WHITE	60.0	FT	30	9
6145012046478	CABLE 1/C 1/0 AWG 19-STR CU THW RED	60.0	FT	30	9
6210008658451	FXTR LTG FLUOR INDL RS 2-40 W STL	56.0	EA	784	9
6240001522987	LAMP FLUORESCENT F40T12 COOL WHITE	122.0	EA	244	9
6240009908191	LAMP INCANDESCENT 115V 100W A21 BLB	28.0	EA	6	9
9505001989119	WIRE STEEL NO.1020 .080IN DIA 12LB	8.4	CL	149	9
9520005961813	ANGLE, STRUCTUAL STEEL	650.0	FT	33	9
5305009010768	SCREW,WOOD,0.190 WOOD,2IN,STL,CAD	3.6	HD	0	
5305012764262	SCREW, SELF DRILLING #12 X 3/4"	8.0	HD	0	
5650002701483	ROOFING FELT 15 LB 3 FT WIDE 324 SF	2.5	RO	125	
6210008937241	FXTR LTG WP 100 W WALL MTG STL	18.0	EA	108	

Replacement camp -- 375 soldiers

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
83190AA	Cesspool	3.0
87190AA	Site preparation 1 acre	7.5
85130FW	Road prep 1 mile	0.1
85110BM	Road surface 1 mile	0.1
85210BR	Hardstand prep 1000 SY	0.5
85110DF	Hardstand surface 1000 sy	0.5

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
0	48222	0	1683	49905	374.8

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
4710002731037	PIPE CULV NEST STL 2SECT 3FTX25.5IN	75.5	EA	8305	4
4710002731038	PIPE CULV NEST STL 2SECT 4FTX25.5IN	99.5	EA	14228	4
4710002731039	PIPE CULV NEST STL 2SECT 2FTX25.5IN	15.5	EA	837	4
473000Z020073	CROSS 6 IN X 6 IN X 4 IN CI	3.0	EA	18	4
473000Z020080	REDUCER 6 IN X 4 IN CI	6.0	EA	12	4
473000Z020091	TEE 4 IN X 4 IN X 4 IN CI	54.0	EA	270	4
473000Z020101	90 DEGREE BEND 4 IN CI	12.0	EA	48	4
5610002504676	CEMENT PORT GEN CONC CONSTR 94LB	216.0	BG	20304	4

Representative Bills of Materials for Base Development Tasks

561000Z010001	AGGREGATE COARSE LOCAL PROCURE	228.7	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	105.9	CD	0	4
561000Z010003	MINERAL FILLER,LOCAL PROCUREMENT	40.2	CD	0	4
811000Z020001	KK GAL DRUM	60.0	EA	4200	4
4710002731042	PIPE CULV NEST STL 2SECT 1.5X25.5IN	21.7	EA	738	9
5335002629445	WIRE FABRIC WELDED 6X6 MESH 750SQFT	3.0	RO	945	9

Hardstand - 1000 SY

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
85110FL	Road Hardstand 1000 SY	1

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
200	9900	0	0	10140	448.0

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
9330010103190	POLYETHYLENE 16X100FT LONG	8.0	RO	200	2
5610009264548	ASPHALT,PETROLEUM PAVING	22.0	DR	9900	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	4.0	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	11.0	CD	0	4
561000Z010004	FINE GRAIN SOIL LOCAL PROCUREMENT	417.0	CD	0	4
561000Z010005	BLOTTER SAND LOCAL PROCUREMENT	16.0	CD	0	4
9330001623982	POLYPROPYLENE-FABRIC 15X300FT LONG	3.0	RO	240	

MSR Construction - 1 Mile

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
85110AB	Class A Road, 2 12 ft lanes	1

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
0	204300	0	0	204300	2458.0

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
5610002330026	ASPHALT PAVING RC-800 55 GAL DRUM	326.0	DR	146700	4
5610009264548	ASPHALT,PETROLEUM PAVING	128.0	DR	57600	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	1577.0	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	674.0	CD	0	4
561000Z010003	MINERAL FILLER,LOCAL PROCUREMENT	207.0	CD	0	4

Heliport - 37 aircraft (AFCS Installation AG3131)

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
11120AA	RUNWAY W/25 FT SHOULDERS,450 X 60	1.0
11120AB	RUNWAY LENGTH CORRECTION,100 X 60	1.0
11120AC	RUNWAY OVERRUN,100 X 110 FT	2.0
11120AD	APPROACH-DEPARTURE,1500X250-850 FT	4.0
11120AE	CLEAR AREA,1000 SY	38.0
11141AA	TAXI-HOVERLANE,450 X 180 FT	4.5
11320AA	PARKING PAD,9EA 12 X 12 FT	2.3
11320AB	PARKING PAD,4EA 20 X 20 FT	4.3
11370AB	AIRCRAFT WASHING APRON,50 X 25 FT	1.0
11371AB	DEFUEL/DECONTN APR,50 X 25 FT	1.0
11380AA	AC LOADING APR,2EA 50 X 25 FT	2.0

Representative Bills of Materials for Base Development Tasks

12110AC	HOT REFUELING PAD,2EA 50 X 50 FT	1.0
12110AH	SUPPORT ACFT REFUELING 30000 G STOR	2.0
13315AA	AC CONTROL STATION,20 X 20 FT	1.0
13470AA	WIND DIRECTION INDICATOR	1.0
14111AA	FIRE AND RESCUE STATION,20 X 20 FT	1.0
42183AA	AMMUNITION STORAGE,700SF	1.0
85110CK	ROAD PAVEMENT,CLASS C,6IN STBL 1MI	1.5
85110DG	HARDSTAND,APR,TXWY,OR RNWY 1000SQYD	0.2
85130KH	ROAD,CLASS C,GRADED AND DRAINED 1MI	1.5
85210AY	HARDSTAND GRADED AND DRAINED 1000SY	0.2
87120AC	DRAINAGE HELIPORT,11 ACRES	1.0

MATERIALS	Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
	261	85291	92717	2655	180924	2711.4

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
4210009651108	EXTINGUISHER FIRE DRY CHEM 20LB CAP	4.0	EA	156	2
6660005277238	SOCK INDICATOR WIND	1.0	EA	105	2
4710002731037	PIPE CULV NEST STL 2SECT 3FTX25.5IN	189.0	EA	20790	4
4710002731038	PIPE CULV NEST STL 2SECT 4FTX25.5IN	110.4	EA	15787	4
4710002731039	PIPE CULV NEST STL 2SECT 2FTX25.5IN	37.5	EA	2025	4
5510002206178	LUMBER SOFTWOOD DIM 2 COM 4X4XRL	44.0	BF	118	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	1220.2	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	1029.5	CD	0	4
561000Z010003	MINERAL FILLER,LOCAL PROCUREMENT	461.7	CD	0	4
5660002248663	BARBED WIRE 2 STRAND 100LB SPOOLS	6.0	SL	633	4
5660002701587	POST FENCE STEEL 5 FT O/ALL LENGTH	294.0	EA	2940	4
5660002701589	POST,FENCE,METAL	12.0	EA	59	4
5660009215516	BARBED TAPE CONCERTINA 37.5-50FTLG	71.2	RL	2670	4
5680002671667	STEEL BAR REINFORCING 1/2IN X 20 FT	36.0	LG	540	4
5680005332731	MEMBRANE SURFACING 53 FT X 66 FT	47.5	EA	38000	4
8010000822599	PAINT AFLD RUNWAY MARKING WHITE	34.4	CN	1720	4
9505002440674	WIRE STEEL NO.1020 .1350IN DIA 12LB	0.6	CL	9	4
4930009992815	FUEL SYSTEM,SUPPLY 300 GPM	2.0	EA	11840	7
5430006418552	TANK ASSY FABRIC COLLAPSIBLE 10000G	6.0	SE	5700	7
5680001736828	MEMBRANE HEAVY DUTY PART 1 OUTFIT	1.0	EA	26643	7
5680001736832	MEMBRANE HEAVY DUTY PART 5 OUTFIT	14.6	EA	36500	7
6210009261252	LIGHT SET,AIRFIELD RUNWAY	5.5	SE	11313	7
6210009397435	LIGHT SET,HELIPORT	1.0	SE	721	7
4710002731042	PIPE CULV NEST STL 2SECT 1.5X25.5IN	37.5	EA	1275	9
4720000830044	HOSE ASSBLY RUB 4IN IDX12FT 600PSI	14.0	EA	1120	9
4730000752407	FITTING ASSY 4IN FLG W/ 3/4IN COUPL	2.0	EA	60	9
4730000752408	FITTING ASSY QUICK DISCON ASM-J 4IN	2.0	EA	200	9

Representative Bills of Materials for Base Development Tasks

Pipeline construction -17 miles (AFCS Installation PD1029)

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
12510BE	PPLN POL 5 MILE OF 6 INCH GROOVE	3.0
12510BN	PPLN POL 1 MILE- 6 IN API GROVE	2.0
12530AL	PUMP STATION FUEL SUPPLY, POL, FOR	1.0
12530AN	PUMP STATION POL FOR 6 IN PIPELINE	1.0
41180AC	TANK, POL, 500 BARREL, W/4 IN PIPE	1.0
87210AR	FENCE, BARBED WIRE, 10 X 1000 FT	0.4
87210AT	FENCE, GATE, PERSONNEL/VEHICLE	1.0

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
786022	7563	1035	342504	1156212	251.2

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
3439002622671	ELECTRODE WELDING 1/8" F/STEEL	160.0	CO	8000	2
3439002622678	ELECTRODE WELDING 5/32"X14" LG	300.0	LB	300	2
3835006417497	VALVE SECTION GTE 500PSI 4INX3FT LG	11.0	EA	3135	2
3835006418430	VALVE SECTION GTE 720PSI 4INX3FT LG	1.0	EA	522	2
3835006634679	VALVE SECTION PLUG 500PSI 4INX3FT	1.0	EA	138	2
4030006348589	CLAMP WIRE ROPE SADDLED U-BLT 1/4IN	4.0	EA	1	2
4210009651108	EXTINGUISHER FIRE DRY CHEM 20LB CAP	7.0	EA	273	2
4710002030183	TUBE STEEL 6.625X 20FT GROOVED ENDS	4368.0	LG	773136	2
4710002030186	TUBE STEEL 4.5IN X 20FT GROOVD ENDS	6.0	LG	424	2
4730001421591	COUPLING CLAMP PIPE F/ 8IN GRVD END	2.0	EA	43	2
4730002027201	CAP PIPE MALL IRON ENAMELED 4 IN	3.0	EA	8	2
4940002778008	CLEANING ELEMENT PIPELINE 6 IN PIPE	2.0	EA	42	2
401000Z640032	INTERLACING WIRE, 10 GAGE	2.2	RO	2	4
4730002736324	TEE PIPE MALL IRON 4 IN	2.0	EA	24	4
4730002738299	ELBOW PIPE MALL IRN 4IN X 45 DEG	8.0	EA	42	4
4730002738313	ELBOW PIPE MALL IRN 6IN X 45 DEG	1.0	EA	12	4
4730002738359	ELBOW PIPE,IRON,90 DEGREE/6"	10.0	EA	182	4
4730002937110	TEE PIPE MALL IRN 6IN X 6IN X 6IN	13.0	EA	338	4
5315001619862	STAPLE FENCE 1-1/2L	28.0	LB	29	4
5315007533885	NAIL COMMON 3.5 IN 16D	4.4	PG	22	4
5510002206194	LUMBER,SOFTWOOD DIM 2X4XRL	44.8	BF	112	4
5510005519659	LUMBER SOFTWOOD DIM TRTD 4X4X12 FT	905.2	BF	2426	4
5610002504677	PORTLAND CEMENT, HIGH EARLY STRNTH	6.6	BG	620	4
561000Z010001	AGGREGATE COARSE LOCAL PROCURE	250.0	CD	0	4
561000Z010002	AGGREGATE FINE LOCAL PROCUREMENT	1.2	CD	0	4
5660002248663	BARBED WIRE 2 STRAND 100LB SPOOLS	30.2	SL	3188	4
5660002646655	POST, FENCE, RND, MTL, 2", 12 FT	2.0	EA	70	4
5660002697803	WIRE, FENCE, GALV, 7 FT, 2" MESH	0.1	RO	32	4
5660007204530	WIRE, FENCE, STL, 10 FT, 2" MESH	0.3	RL	106	4
5660009131527	BAND, TENSION, 3"	16.0	EA	5	4
5660009695266	BAND, TENSION, 4" POST	16.0	EA	8	4
566000Z640002	CLAMPS, TRUSS WIRE	8.0	EA	8	4
566000Z640003	GATE CORNER CONNECTORS, 2"	8.0	EA	8	4
566000Z640004	CAP, GATE POST, 4"	2.0	EA	2	4
566000Z640005	GATE HINGE ASSEMBLY, 4"	2.0	EA	4	4
566000Z640006	GATE LATCH ASSEMBLY, 4" & 2"	1.0	EA	2	4
566000Z640007	GATE KEEPER ASSEMBLY	1.0	EA	2	4
566000Z640009	CAP, GATE POST, 3"	2.0	EA	4	4
566000Z640010	GATE HINGE ASSEMBLY, 3"	2.0	EA	4	4
566000Z640011	GATE LATCH ASSEMBLY, 3" & 2"	1.0	EA	3	4
566000Z640020	POST, FENCE, RND, GALV, 3", 13 FT	2.0	EA	100	4
566000Z640021	BRACE RAIL CLAMPS & BOLTS, 2.5"	12.0	EA	12	4
566000Z640022	STRETCHER BAR, 10', GALV STEEL	4.0	EA	12	4
566000Z640023	10' SCH 40 2.5" DIA GALV STL BRACE	4.0	EA	4	4
566000Z640024	2.5" 3 FOOT STEEL BRACE	2.0	EA	2	4

Representative Bills of Materials for Base Development Tasks

5660010159800	POST, FENCE, MTL, 4", 13 FT LNGTH	2.0	EA	52	4
5660012486719	POST, FENCE, MTL, 2", 6 FT LNGTH	1.0	EA	25	4
5660012502947	POST, FENCE, METAL, 2", 10 FT LNGTH	4.0	EA	91	4
5660012644767	TIE WIRES, FENCE FAB, ALUM 9 GA.	0.2	PG	10	4
4320000802059	PUMP CTRF,OD SM 600 GPM 1630 FT HD	4.0	EA	920	7
5430002636077	TANK LIQ STOR METAL POL 21000 GAL	1.0	EA	115	7
3835006417487	VALVE SECTION CHECK 6 INCH CLAS 250	10.0	EA	3830	9
4010001328050	CHAIN ASSBLY SGL 1/4IN X 8FT 4500LB	1.0	EA	6	9
4010002699364	WIRE ROPE STEEL 3/16 IN X 600 FT	0.2	RL	48	9
4010002728794	WIRE ROPE STEEL 3/8 IN X 600 FT	0.2	RL	29	9
4710001621016	PIPE STEEL GALV 1/4INX16-22FT THDS	10.0	FT	88	9
4710001621019	PIPE STEEL GALV 3/4INX16-22FT THDS	40.0	FT	45	9
4710001621021	PIPE STEEL GALV 1.25INX16-22FT THD	5.0	FT	11	9
4710001621022	PIPE STEEL GALV 2INX16-22FT THRDS	40.0	FT	147	9
4710002026755	PIPE STEEL 6INX17-22FT R/L BEV ENDS	1500.0	FT	28770	9
4710002027905	PIPE,STEEL 6IN.X20FT GROOVED ENDS	586.0	LG	222680	9
4710002027906	PIPE STEEL 4IN X 20FT GROOVED ENDS	7.0	LG	1534	9
4710002731042	PIPE CULV NEST STL 2SECT 1.5X25.5IN	400.0	EA	13600	9
4720005950078	HOSE ASSY RUBBER 3/4"X24" 500PSI	4.0	EA	16	9
4730001286813	TEE PIPE CAST IRON GLV 3/4IN	2.0	EA	2	9
4730001421590	COUPLING CLAMP PIPE F/ 4IN GRVD END	89.0	EA	601	9
4730001877568	COUPLING PIPE CARB STL 1/4IN XTRHVY	1.0	EA	0	9
4730001878761	NIPPLE PIPE STL 3/4IN X 2IN XTRSTRG	8.0	EA	1	9
4730001892628	UNION PIPE IRN/STL GALV 1.25IN FMLE	1.0	EA	1	9
4730001892634	UNION PPE IRN/STL GLV 2IN FE 500PSI	2.0	EA	6	9
4730001960835	BUSHING PIPE MI BLK 1-1/4X3/4 IN.	2.0	EA	1	9
4730002026738	CLAMP LEAK RPR PIPE CPL 4IN NOM SZE	2.0	EA	140	9
4730002026739	CLAMP LEAK RPR PIPE CPL 6IN NOM SZE	35.0	EA	3211	9
4730002029509	REDUCER,PIPE,6"X4",MALL IRON	13.0	EA	83	9
4730002213910	ELBOW PIPE GALV 1.25INX 90DEG CASTI	2.0	EA	1	9
4730002542258	BUSHING PIPE GALV 1 IN X 1/2 IN	2.0	EA	0	9
4730002635269	TEE PIPE MALL IRON 1.25 IN	1.0	EA	1	9
4730002635271	TEE PIPE MALL IRON 2 IN	1.0	EA	6	9
4730002738322	ELBOW PIPE MALL IRN 4IN X 90 DEG	12.0	EA	96	9
4730002738623	CAP PIPE MALL IRON ENAMELED 8 IN	2.0	EA	33	9
4730002778787	BUSHING PIPE STEEL 1.25IN X 1IN	2.0	EA	2	9
4730002779453	NIPPLE PIPE STEEL GALV 1/4X1.5IN LG	1.0	EA	0	9
4730002783410	PLUG PIPE CI SQUARE HEAD 2IN THRD	1.0	EA	1	9
4730002783597	ELBOW PIPE MALL IRON 3/4IN X 90 DEG	10.0	EA	8	9
4730002871654	ELBOW PIPE MALL IRN 2INX2.5IN 90DEG	3.0	EA	12	9
4730002889514	CLAMP COUPLING FOR 6IN GROOVED PIPE	5111.0	EA	66443	9
4730003377471	PIPELINE BARREL CLEANER TRAP 6INOUT	1.0	EA	362	9
4730003593872	PLUG PIPE STEEL 3/4 IN SOLID	1.0	EA	0	9
4730005411423	BUSHING PIPE STEEL 2 IN X 1 IN	2.0	EA	2	9
4730006406234	CAP PIPE GRVD 4" MI W/2"NPT PLUG	2.0	EA	7	9
4730008255965	BUSHING PIPE STEEL 2IN X 3/4IN	1.0	EA	2	9
4730009058059	NIPPLE PIPE STEEL GALV 2IN X 6IN LG	6.0	EA	10	9
4820002873897	VALVE NEEDLE GLOBE 1/4 NPT 3000PSI	1.0	EA	0	9
4820004184802	VALVE GATE STEEL 2IN SCR 600PSI WOG	3.0	EA	127	9
4820005410371	VALVE GLOBE F.A.60CFM-100-85	4.0	EA	64	9
4820008138518	VALVE GATE BRZ SCREW 1.25IN 300PSI	1.0	EA	6	9
4820010272229	VALVE GLOBE STEEL SCR 1/2IN 3MWP	2.0	EA	2	9
5306002574224	BOLT OVAL,.750-10UNC,4.50IN	300.0	EA	153	9
5315001619859	STAPLE,FENCE	100.0	LB	100	9
5330001414225	PACKING PREFORMED SYN RUBBER	251.0	EA	88	9
5340001880330	TURNBUCKLE, STL, 3/8" X 12" C&C	4.0	EA	4	9
5340002402593	HINGE TEE 4IN	2.0	PR	1	9
5340002918236	HINGE TEE WROUGHT STL LEAVES 6IN LG	1.5	PR	1	9
9515005962442	STEEL PLATE CARBON 1/4X36X96 INCH	0.5	PM	122	9
3835006417488	VALVE SECTION GTE 500PSI 6INX3FT LG	26.0	EA	16510	

Representative Bills of Materials for Base Development Tasks

3835006934508	VALVE ASSEMBLY PRESSUR RELIEF 1/2IN	7.0	EA	53	
4710002027202	PIPE BENT STEEL 1/2IN 2IN RAD 180DG	2.0	EA	4	
4730002029505	REDUCER PIPE MI 12IN TO 8INX7IN LNG	13.0	EA	351	
4730002223739	CLAMP REPAIR PIPE STEEL 6 INCH X 12	34.0	EA	680	
4730002738610	CAP PIPE MALL IRON ENAMELED 6 IN	1.0	EA	7	
4730002782669	COUPLING PPE STL 6INX6IN LG UNTHD	72.0	EA	882	
4730003377470	PIPELINE BARREL CLEANER TRAP 6IN IN	1.0	EA	601	
4730008254031	BUSHING PIPE STEEL 1IN X 3/4IN	2.0	EA	0	

MSR Maintenance -100 miles for 30 days

FACILITIES

FAC_NO	DESCRIPTION	QUANTITY
85140AC	Road Maintenance	1

MATERIALS

Class II	Class IV	Class VII	Class IX	TOTAL LB	Local CY
0	169338	0	952	170290	0.0

NSN	NOMEN	QUANTITY	UI	TOT_WGT	CLASS
4710002731036	PIPE CULV NEST STL 2SECT 5FTX25.5IN	28.0	EA	6300	4
4710002731037	PIPE CULV NEST STL 2SECT 3FTX25.5IN	56.0	EA	6160	4
4710002731038	PIPE CULV NEST STL 2SECT 4FTX25.5IN	28.0	EA	4004	4
4710002731039	PIPE CULV NEST STL 2SECT 2FTX25.5IN	56.0	EA	3024	4
5610002330020	ASPHALT PAVING MC-800 55 GAL DRUM	256.0	DR	115200	4
5610002330026	ASPHALT PAVING RC-800 55 GAL DRUM	77.0	DR	34650	4
4710002731042	PIPE CULV NEST STL 2SECT 1.5X25.5IN	28.0	EA	952	9

Representative Bills of Materials for Base Development Tasks

UNIT OF ISSUE (UI) GLOSSARY		
ABBREV.	**UNIT OF ISSUE**	**DESCRIPTION**
BF	BOARD FOOT	A UNIT OF MEASURE FOR LUMBER EQUAL TO THE VOLUME OF A BOARD 12"x12"x1".
BG	BAG	A FLEXIBLE CONTAINER OF VARIOUS SIZES AND SHAPES MADE FROM SUCH MATERIALS AS PAPER, PLASTIC, OR TEXTILES.
BX	BOX	A RIGID, 3-DIMENSIONAL CONTAINER OF VARIOUS SIZES AND MATERIALS.
CD, CY	CUBIC YARD	THE VOLUME OF A CUBE ONE YARD (3 FEET) IN LENGTH, WIDTH, AND DEPTH.
CL	COIL	AN ARRANGEMENT OF MATERIAL SUCH AS WIRE, ROPE, AND TUBING WOUND IN A CIRCULAR SHAPE.
CO	CONTAINER	A GENERAL TERM USED ONLY WHEN AN ITEM CAN BE PACKAGED FOR ISSUE IN OPTIONAL CONTAINERS, SUCH AS BOTTLE OR TUBE FOR A SINGLE NSN.
DR	DRUM	A CYLINDER-SHAPED CONTAINER DESIGNED AS AN EXTERIOR PACK TO STORE AND SHIP BULK MATERIALS. DRUMS MAY BE MADE OF METAL, RUBBER, POLYETHYLENE, OR PLYWOOD OR FIBRE ENDS.
EA	EACH	ONE ITEM OF SUPPLY
FT	FOOT	UNIT OF LINEAR MEASUREMENT, SOMETIMES EXPRESSED AS "LINEAR FOOT"
GL	GALLON	UNIT OF LIQUID MEASUREMENT.
HD	HUNDRED	ONE HUNDRED (100) OF AN ITEM.
LB	POUND	A UNIT OF AVOIRDUPOIS WEIGHT EQUAL TO 16 OUNCES.
LG	LENGTH	APPLIES TO ITEMS ISSUED IN FIXED OR SPECIFIC LINEAR MEASUREMENT, WITHOUT DEVIATION.
PG	PACKAGE	COMES WITH PROTECTIVE WRAPPING FOR TWO OR MORE OF THE SAME ITEM
PM	PLATE	A FLAT PIECE OF SQUARE OR RECTANGULAR-SHAPED METAL OF UNIFORM THICKNESS, USUALLY 1/4 INCH OR MORE.
PR	PAIR	TWO SIMILAR OR IDENTICAL ITMES OR ITEMS INTEGRALLY MADE OF TWO IDENTICAL PARTS.
RL	REEL	A CYLINDER-SHAPED CORE ON WHICH A FLEXIBLE MATERIAL, SUCH AS WIRE OR CABLE, IS WOUND. USUALLY HAS FLANGED ENDS.
RO	ROLL	A CYLINDER-SHAPED FIGURE OF FLEXIBLE MATERIAL

Representative Bills of Materials for Base Development Tasks

		WHICH HAS BEEN ROLLED ON ITSELF SUCH AS TEXTILES, TAPE, ABRASIVE PAPER, PHOTOSENSITIVE PAPER AND FILM.
SE	SET	A GROUP OF MATCHED OR RELATED ITEMS ISSUED AS A SINGLE ITEM OF SUPPLY, SUCH AS TOOL SETS, INSTRUMENT SETS, AND MATCHED SETS.
SH	SHEET	A FLAT PIECE OF RECTANGULAR-SHAPED MATERIAL OF UNIFORM THICKNESS THAT IS VERY THIN IN RELATION TO ITS LENGTH AND WIDTH, SUCH AS METAL, PLASTIC, PAPER, AND PLYWOOD.
SL	SPOOL	A CYLINDER-SHAPED FORM WITH AN EDGE OR RIM AT EACH END AND AN AXIAL HOLE FOR A PIN OR SPINDLE TO WIND FLEXIBLE MATERIAL SUCH AS THREAD OR WIRE ON.
YD	YARD	A UNIT OF LINEAR MEASURE EQUAL TO 3 FEET AND SOMETIMES EXPRESSED AS "LINEAR YARD."

Appendix G: Scenario Data Sets Generated by the Model C4

This appendix contains a listing of the sample data sets collected from the study's Class IV model, C4. As explained in Chapter 5, the study assumed:

- The divisional forces are structured into two cases: (1) a heavy force of 2 armor and 3 mechanized divisions with an ACR and a separate armor brigade; and (2) a light force of 3 light infantry divisions, an airborne division, and an air assault division with an ACR and a separate mechanized brigade, and

- The only base development tasks not fully supported by host nation or contractor resources are construction, maintenance, and repair of airports, roads, pipelines, supply storage facilities, EPW camps, and DEPMEDs.

In these tables, the scenario number is used only for reference. Model inputs were:

- Length of conflict (in days),
- Type of force (Heavy or Light, as described above),
- Level of existing infrastructure, with the following definitions:

  Well-developed: 90 percent of required LOC/facilities either available or supplied by host nation or contractor support; no field latrines in corps area or COMMZ.

  Developing: 50 percent of required LOC/facilities either available or supplied by host nation or contractor support.

  Austere: little or no availability of required LOC/facilities and maximum use of troop construction.
- Enemy long-distance strike capability, with the following definitions:

  None: threat has no long-distance strike capability, requiring no overhead cover or damage repair.

  Some: threat has some long-distance strike capability that requires overhead cover but little damage repair.

High: threat has long-distance strike capability, requiring both overhead fortification and extensive damage repair.

- Movement pattern limited to three cases of low (L) and high (H) movement periods: (1) a stationary force requiring only a single original position (LLL), (2) a force moving in the pattern observed in the TAA scenarios of withdraw, defend and build, then attack (HLH), and (3) a force moving to a new location every 20 days (HHH).
- Size of the initial force, and
- Number of days to deploy half of the total force.

The C4 outputs were:

- Predicted total pounds of Class IV supplies consumed under the given conditions,
- Overall average Class IV consumption rate (average of consumption rates for each 10-day period for the length of conflict).

The final two columns of this table represent the scenario's consumption rate as predicted by the study's Class IV planning factor algorithm (Table 5-4) and the percent difference between the rates predicted by C4 and the algorithm.

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
1	120	Heavy	Austere	High	HHH	5,000	60	315,808,595	23.96	26.07	0.09
2	120	Heavy	Austere	High	HHH	20,000	60	315,840,384	22.08	23.50	0.06
3	120	Heavy	Austere	High	HHH	50,000	60	315,903,962	19.82	20.62	0.04
4	120	Heavy	Austere	High	HLH	5,000	60	270,654,220	21.55	22.00	0.02
5	120	Heavy	Austere	High	HLH	20,000	60	272,040,279	19.82	19.83	0.00
6	120	Heavy	Austere	High	HLH	50,000	60	274,812,398	17.71	17.40	-0.02
7	120	Heavy	Austere	High	LLL	5,000	60	199,472,869	17.19	14.83	-0.14
8	120	Heavy	Austere	High	LLL	20,000	60	193,999,451	14.66	13.37	-0.09
9	120	Heavy	Austere	High	LLL	50,000	60	183,052,616	11.76	11.73	0.00
10	120	Heavy	Austere	None	HHH	5,000	60	215,645,859	16.43	16.82	0.02
11	120	Heavy	Austere	None	HHH	20,000	60	215,249,773	15.04	15.16	0.01
12	120	Heavy	Austere	None	HHH	50,000	60	214,457,600	13.39	13.30	-0.01
13	120	Heavy	Austere	None	HLH	5,000	60	177,310,594	14.40	14.19	-0.01
14	120	Heavy	Austere	None	HLH	20,000	60	178,099,218	13.14	12.79	-0.03
15	120	Heavy	Austere	None	HLH	50,000	60	179,676,467	11.62	11.22	-0.03
16	120	Heavy	Austere	None	LLL	5,000	60	117,240,823	10.69	9.57	-0.11
17	120	Heavy	Austere	None	LLL	20,000	60	112,105,893	8.73	8.63	-0.01
18	120	Heavy	Austere	None	LLL	50,000	60	101,836,035	6.53	7.57	0.16
19	120	Heavy	Austere	Some	HHH	5,000	60	280,984,370	21.37	22.48	0.05
20	120	Heavy	Austere	Some	HHH	20,000	60	280,584,687	19.60	20.27	0.03
21	120	Heavy	Austere	Some	HHH	50,000	60	279,785,323	17.49	17.78	0.02
22	120	Heavy	Austere	Some	HLH	5,000	60	234,976,055	18.93	18.97	0.00
23	120	Heavy	Austere	Some	HLH	20,000	60	235,994,093	17.32	17.10	-0.01
24	120	Heavy	Austere	Some	HLH	50,000	60	238,030,170	15.36	15.00	-0.02
25	120	Heavy	Austere	Some	LLL	5,000	60	162,840,301	14.48	12.79	-0.12
26	120	Heavy	Austere	Some	LLL	20,000	60	156,760,925	12.03	11.53	-0.04
27	120	Heavy	Austere	Some	LLL	50,000	60	144,602,172	9.26	10.12	0.09

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
28	120	Heavy	Developing	High	HHH	5,000	60	288,665,164	21.95	23.25	0.06
29	120	Heavy	Developing	High	HHH	20,000	60	288,619,402	20.19	20.96	0.04
30	120	Heavy	Developing	High	HHH	50,000	60	288,527,878	18.09	18.39	0.02
31	120	Heavy	Developing	High	HLH	5,000	60	243,510,789	19.53	19.62	0.00
32	120	Heavy	Developing	High	HLH	20,000	60	244,819,297	17.93	17.69	-0.01
33	120	Heavy	Developing	High	HLH	50,000	60	247,436,314	15.98	15.52	-0.03
34	120	Heavy	Developing	High	LLL	5,000	60	172,329,438	15.18	13.23	-0.13
35	120	Heavy	Developing	High	LLL	20,000	60	166,778,469	12.77	11.93	-0.07
36	120	Heavy	Developing	High	LLL	50,000	60	155,676,532	10.03	10.46	0.04
37	120	Heavy	Developing	None	HHH	5,000	60	213,194,758	16.28	16.62	0.02
38	120	Heavy	Developing	None	HHH	20,000	60	212,608,656	14.87	14.99	0.01
39	120	Heavy	Developing	None	HHH	50,000	60	211,436,454	13.19	13.15	0.00
40	120	Heavy	Developing	None	HLH	5,000	60	174,859,492	14.25	14.03	-0.02
41	120	Heavy	Developing	None	HLH	20,000	60	175,458,102	12.96	12.65	-0.02
42	120	Heavy	Developing	None	HLH	50,000	60	176,655,321	11.42	11.09	-0.03
43	120	Heavy	Developing	None	LLL	5,000	60	114,789,721	10.54	9.46	-0.10
44	120	Heavy	Developing	None	LLL	20,000	60	109,464,777	8.56	8.53	0.00
45	120	Heavy	Developing	None	LLL	50,000	60	98,814,889	6.33	7.48	0.18
46	120	Heavy	Developing	Some	HHH	5,000	60	264,663,239	20.17	20.85	0.03
47	120	Heavy	Developing	Some	HHH	20,000	60	264,084,826	18.45	18.80	0.02
48	120	Heavy	Developing	Some	HHH	50,000	60	262,928,002	16.41	16.49	0.00
49	120	Heavy	Developing	Some	HLH	5,000	60	218,654,924	17.72	17.60	-0.01
50	120	Heavy	Developing	Some	HLH	20,000	60	219,494,232	16.17	15.86	-0.02
51	120	Heavy	Developing	Some	HLH	50,000	60	221,172,849	14.28	13.91	-0.03
52	120	Heavy	Developing	Some	LLL	5,000	60	146,519,170	13.28	11.86	-0.11
53	120	Heavy	Developing	Some	LLL	20,000	60	140,261,064	10.88	10.70	-0.02
54	120	Heavy	Developing	Some	LLL	50,000	60	127,744,851	8.18	9.38	0.15

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
55	120	Heavy	Well Developed	High	HHH	5,000	60	215,747,549	16.82	17.18	0.02
56	120	Heavy	Well Developed	High	HHH	20,000	60	215,786,875	15.43	15.49	0.00
57	120	Heavy	Well Developed	High	HHH	50,000	60	215,865,526	13.77	13.59	-0.01
58	120	Heavy	Well Developed	High	HLH	5,000	60	179,436,105	14.88	14.50	-0.03
59	120	Heavy	Well Developed	High	HLH	20,000	60	180,556,419	13.61	13.07	-0.04
60	120	Heavy	Well Developed	High	HLH	50,000	60	182,797,049	12.07	11.46	-0.05
61	120	Heavy	Well Developed	High	LLL	5,000	60	122,111,259	11.39	9.78	-0.14
62	120	Heavy	Well Developed	High	LLL	20,000	60	117,738,504	9.46	8.81	-0.07
63	120	Heavy	Well Developed	High	LLL	50,000	60	108,992,993	7.30	7.73	0.06
64	120	Heavy	Well Developed	None	HHH	5,000	60	161,551,147	12.74	12.82	0.01
65	120	Heavy	Well Developed	None	HHH	20,000	60	161,034,666	11.58	11.56	0.00
66	120	Heavy	Well Developed	None	HHH	50,000	60	160,001,703	10.21	10.14	-0.01
67	120	Heavy	Well Developed	None	HLH	5,000	60	132,060,152	11.17	10.82	-0.03
68	120	Heavy	Well Developed	None	HLH	20,000	60	132,455,059	10.12	9.75	-0.04
69	120	Heavy	Well Developed	None	HLH	50,000	60	133,244,872	8.85	8.55	-0.03
70	120	Heavy	Well Developed	None	LLL	5,000	60	85,848,985	8.32	7.29	-0.12
71	120	Heavy	Well Developed	None	LLL	20,000	60	81,686,953	6.73	6.58	-0.02
72	120	Heavy	Well Developed	None	LLL	50,000	60	73,362,887	4.94	5.77	0.17
73	120	Heavy	Well Developed	Some	HHH	5,000	60	201,781,282	15.77	15.80	0.00
74	120	Heavy	Well Developed	Some	HHH	20,000	60	201,274,113	14.37	14.24	-0.01
75	120	Heavy	Well Developed	Some	HHH	50,000	60	200,259,775	12.72	12.49	-0.02
76	120	Heavy	Well Developed	Some	HLH	5,000	60	164,615,898	13.80	13.33	-0.03
77	120	Heavy	Well Developed	Some	HLH	20,000	60	165,253,168	12.53	12.02	-0.04
78	120	Heavy	Well Developed	Some	HLH	50,000	60	166,527,708	11.00	10.54	-0.04
79	120	Heavy	Well Developed	Some	LLL	5,000	60	106,336,650	10.21	8.99	-0.12
80	120	Heavy	Well Developed	Some	LLL	20,000	60	101,242,912	8.26	8.10	-0.02
81	120	Heavy	Well Developed	Some	LLL	50,000	60	91,055,437	6.07	7.11	0.17

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
82	120	Light	Austere	High	HHH	5,000	60	280,135,584	27.94	30.48	0.09
83	120	Light	Austere	High	HHH	20,000	60	280,332,932	25.35	26.99	0.06
84	120	Light	Austere	High	HHH	50,000	60	280,725,377	22.43	23.28	0.04
85	120	Light	Austere	High	HLH	5,000	60	242,166,253	25.26	25.80	0.02
86	120	Light	Austere	High	HLH	20,000	60	243,872,536	22.87	22.85	0.00
87	120	Light	Austere	High	HLH	50,000	60	247,282,851	20.11	19.71	-0.02
88	120	Light	Austere	High	LLL	5,000	60	181,414,162	20.25	17.21	-0.15
89	120	Light	Austere	High	LLL	20,000	60	175,457,903	16.83	15.23	-0.09
90	120	Light	Austere	High	LLL	50,000	60	163,543,132	13.16	13.14	0.00
91	120	Light	Austere	None	HHH	5,000	60	181,247,897	18.20	18.56	0.02
92	120	Light	Austere	None	HHH	20,000	60	180,873,138	16.36	16.43	0.00
93	120	Light	Austere	None	HHH	50,000	60	180,123,620	14.31	14.18	-0.01
94	120	Light	Austere	None	HLH	5,000	60	149,587,183	15.98	15.71	-0.02
95	120	Light	Austere	None	HLH	20,000	60	150,516,729	14.30	13.91	-0.03
96	120	Light	Austere	None	HLH	50,000	60	152,375,823	12.40	12.00	-0.03
97	120	Light	Austere	None	LLL	5,000	60	99,270,117	11.79	10.48	-0.11
98	120	Light	Austere	None	LLL	20,000	60	93,678,135	9.23	9.28	0.00
99	120	Light	Austere	None	LLL	50,000	60	82,494,173	6.56	8.00	0.22
100	120	Light	Austere	Some	HHH	5,000	60	244,272,708	24.46	25.73	0.05
101	120	Light	Austere	Some	HHH	20,000	60	243,909,162	22.04	22.78	0.03
102	120	Light	Austere	Some	HHH	50,000	60	243,181,678	19.35	19.65	0.02
103	120	Light	Austere	Some	HLH	5,000	60	205,450,662	21.73	21.78	0.00
104	120	Light	Austere	Some	HLH	20,000	60	206,680,917	19.53	19.28	-0.01
105	120	Light	Austere	Some	HLH	50,000	60	209,141,032	17.00	16.63	-0.02
106	120	Light	Austere	Some	LLL	5,000	60	143,711,487	16.59	14.52	-0.12
107	120	Light	Austere	Some	LLL	20,000	60	136,960,954	13.31	12.86	-0.03
108	120	Light	Austere	Some	LLL	50,000	60	123,459,496	9.85	11.09	0.13

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
109	120	Light	Developing	High	HHH	5,000	60	252,049,415	25.19	26.78	0.06
110	120	Light	Developing	High	HHH	20,000	60	252,167,319	22.81	23.71	0.04
111	120	Light	Developing	High	HHH	50,000	60	252,403,127	20.14	20.45	0.02
112	120	Light	Developing	High	HLH	5,000	60	214,080,084	22.51	22.67	0.01
113	120	Light	Developing	High	HLH	20,000	60	215,706,923	20.33	20.07	-0.01
114	120	Light	Developing	High	HLH	50,000	60	218,960,601	17.82	17.31	-0.03
115	120	Light	Developing	High	LLL	5,000	60	153,327,994	17.51	15.12	-0.14
116	120	Light	Developing	High	LLL	20,000	60	147,292,290	14.29	13.38	-0.06
117	120	Light	Developing	High	LLL	50,000	60	135,220,883	10.87	11.55	0.06
118	120	Light	Developing	None	HHH	5,000	60	179,619,593	18.03	18.39	0.02
119	120	Light	Developing	None	HHH	20,000	60	179,054,819	16.17	16.28	0.01
120	120	Light	Developing	None	HHH	50,000	60	177,925,271	14.11	14.04	0.00
121	120	Light	Developing	None	HLH	5,000	60	147,958,879	15.81	15.57	-0.02
122	120	Light	Developing	None	HLH	20,000	60	148,698,410	14.12	13.78	-0.02
123	120	Light	Developing	None	HLH	50,000	60	150,177,473	12.19	11.89	-0.03
124	120	Light	Developing	None	LLL	5,000	60	97,641,813	11.62	10.38	-0.11
125	120	Light	Developing	None	LLL	20,000	60	91,859,816	9.05	9.19	0.02
126	120	Light	Developing	None	LLL	50,000	60	80,295,823	6.35	7.93	0.25
127	120	Light	Developing	Some	HHH	5,000	60	228,602,592	22.89	23.66	0.03
128	120	Light	Developing	Some	HHH	20,000	60	228,059,769	20.58	20.95	0.02
129	120	Light	Developing	Some	HHH	50,000	60	226,974,121	18.01	18.07	0.00
130	120	Light	Developing	Some	HLH	5,000	60	189,780,546	20.17	20.03	-0.01
131	120	Light	Developing	Some	HLH	20,000	60	190,831,523	18.06	17.74	-0.02
132	120	Light	Developing	Some	HLH	50,000	60	192,933,476	15.66	15.30	-0.02
133	120	Light	Developing	Some	LLL	5,000	60	128,041,371	15.03	13.36	-0.11
134	120	Light	Developing	Some	LLL	20,000	60	121,111,561	11.85	11.83	0.00
135	120	Light	Developing	Some	LLL	50,000	60	107,251,940	8.50	10.20	0.20

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
136	120	Light	Well Developed	High	HHH	5,000	60	189,669,024	19.49	19.83	0.02
137	120	Light	Well Developed	High	HHH	20,000	60	189,872,016	17.58	17.56	0.00
138	120	Light	Well Developed	High	HHH	50,000	60	190,277,999	15.46	15.15	-0.02
139	120	Light	Well Developed	High	HLH	5,000	60	158,333,325	17.27	16.79	-0.03
140	120	Light	Well Developed	High	HLH	20,000	60	159,771,971	15.52	14.86	-0.04
141	120	Light	Well Developed	High	HLH	50,000	60	162,649,262	13.53	12.82	-0.05
142	120	Light	Well Developed	High	LLL	5,000	60	108,123,793	13.15	11.19	-0.15
143	120	Light	Well Developed	High	LLL	20,000	60	103,266,303	10.55	9.91	-0.06
144	120	Light	Well Developed	High	LLL	50,000	60	93,551,323	7.81	8.55	0.09
145	120	Light	Well Developed	None	HHH	5,000	60	138,517,190	14.41	14.32	-0.01
146	120	Light	Well Developed	None	HHH	20,000	60	138,022,036	12.85	12.68	-0.01
147	120	Light	Well Developed	None	HHH	50,000	60	137,031,728	11.13	10.94	-0.02
148	120	Light	Well Developed	None	HLH	5,000	60	113,491,114	12.65	12.13	-0.04
149	120	Light	Well Developed	None	HLH	20,000	60	114,026,943	11.23	10.74	-0.04
150	120	Light	Well Developed	None	HLH	50,000	60	115,098,600	9.62	9.26	-0.04
151	120	Light	Well Developed	None	LLL	5,000	60	73,718,203	9.34	8.09	-0.13
152	120	Light	Well Developed	None	LLL	20,000	60	69,099,118	7.22	7.16	-0.01
153	120	Light	Well Developed	None	LLL	50,000	60	59,860,948	5.00	6.18	0.24
154	120	Light	Well Developed	Some	HHH	5,000	60	176,260,350	18.15	18.05	-0.01
155	120	Light	Well Developed	Some	HHH	20,000	60	175,788,769	16.23	15.98	-0.02
156	120	Light	Well Developed	Some	HHH	50,000	60	174,845,608	14.12	13.79	-0.02
157	120	Light	Well Developed	Some	HLH	5,000	60	144,071,936	15.89	15.28	-0.04
158	120	Light	Well Developed	Some	HLH	20,000	60	144,920,874	14.14	13.53	-0.04
159	120	Light	Well Developed	Some	HLH	50,000	60	146,618,750	12.17	11.67	-0.04
160	120	Light	Well Developed	Some	LLL	5,000	60	92,875,320	11.63	10.19	-0.12
161	120	Light	Well Developed	Some	LLL	20,000	60	87,109,878	8.99	9.02	0.00
162	120	Light	Well Developed	Some	LLL	50,000	60	75,578,994	6.24	7.78	0.25

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
163	180	Heavy	Austere	High	HHH	5,000	60	466,333,053	20.65	21.42	0.04
164	180	Heavy	Austere	High	HHH	5,000	90	430,364,921	22.95	23.23	0.01
165	180	Heavy	Austere	High	HHH	20,000	60	466,364,841	19.40	19.31	0.00
166	180	Heavy	Austere	High	HHH	20,000	90	432,784,510	20.96	20.94	0.00
167	180	Heavy	Austere	High	HHH	50,000	60	466,428,419	17.90	16.94	-0.05
168	180	Heavy	Austere	High	HHH	50,000	90	437,596,194	18.81	18.37	-0.02
169	180	Heavy	Austere	High	HLH	5,000	60	354,222,530	17.28	18.07	0.05
170	180	Heavy	Austere	High	HLH	5,000	90	341,450,969	19.77	19.60	-0.01
171	180	Heavy	Austere	High	HLH	20,000	60	357,006,922	16.17	16.29	0.01
172	180	Heavy	Austere	High	HLH	20,000	90	345,377,261	17.91	17.67	-0.01
173	180	Heavy	Austere	High	HLH	50,000	60	362,575,707	14.84	14.29	-0.04
174	180	Heavy	Austere	High	HLH	50,000	90	353,202,352	15.86	15.50	-0.02
175	180	Heavy	Austere	High	LLL	5,000	60	245,376,615	12.99	12.19	-0.06
176	180	Heavy	Austere	High	LLL	5,000	90	243,078,791	15.40	13.22	-0.14
177	180	Heavy	Austere	High	LLL	20,000	60	239,903,197	11.30	10.99	-0.03
178	180	Heavy	Austere	High	LLL	20,000	90	237,823,864	12.88	11.92	-0.07
179	180	Heavy	Austere	High	LLL	50,000	60	228,956,362	9.37	9.64	0.03
180	180	Heavy	Austere	High	LLL	50,000	90	227,286,516	10.27	10.45	0.02
181	180	Heavy	Austere	None	HHH	5,000	60	315,980,267	14.05	13.82	-0.02
182	180	Heavy	Austere	None	HHH	5,000	90	287,546,935	15.08	14.99	-0.01
183	180	Heavy	Austere	None	HHH	20,000	60	315,584,181	13.12	12.46	-0.05
184	180	Heavy	Austere	None	HHH	20,000	90	288,993,732	13.75	13.51	-0.02
185	180	Heavy	Austere	None	HHH	50,000	60	314,792,009	12.02	10.93	-0.09
186	180	Heavy	Austere	None	HHH	50,000	90	291,887,327	12.36	11.85	-0.04
187	180	Heavy	Austere	None	HLH	5,000	60	221,558,409	11.21	11.66	0.04
188	180	Heavy	Austere	None	HLH	5,000	90	212,677,055	12.40	12.65	0.02
189	180	Heavy	Austere	None	HLH	20,000	60	223,531,745	10.41	10.51	0.01

Scenario Conditions with the Associated Class IV Consumption Rates

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SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
190	180	Heavy	Austere	None	HLH	20,000	90	215,440,198	11.20	11.40	0.02
191	180	Heavy	Austere	None	HLH	50,000	60	227,478,415	9.46	9.22	-0.03
192	180	Heavy	Austere	None	HLH	50,000	90	220,966,483	9.88	10.00	0.01
193	180	Heavy	Austere	None	LLL	5,000	60	130,432,351	7.59	7.86	0.04
194	180	Heavy	Austere	None	LLL	5,000	90	130,432,351	8.70	8.53	-0.02
195	180	Heavy	Austere	None	LLL	20,000	60	125,297,422	6.28	7.09	0.13
196	180	Heavy	Austere	None	LLL	20,000	90	125,297,422	6.93	7.69	0.11
197	180	Heavy	Austere	None	LLL	50,000	60	115,027,564	4.81	6.22	0.29
198	180	Heavy	Austere	None	LLL	50,000	90	115,027,564	5.13	6.74	0.31
199	180	Heavy	Austere	Some	HHH	5,000	60	414,665,562	18.38	18.47	0.01
200	180	Heavy	Austere	Some	HHH	5,000	90	380,281,761	20.06	20.03	0.00
201	180	Heavy	Austere	Some	HHH	20,000	60	414,265,879	17.20	16.65	-0.03
202	180	Heavy	Austere	Some	HHH	20,000	90	382,116,542	18.30	18.06	-0.01
203	180	Heavy	Austere	Some	HHH	50,000	60	413,466,515	15.79	14.61	-0.07
204	180	Heavy	Austere	Some	HHH	50,000	90	385,783,179	16.41	15.84	-0.03
205	180	Heavy	Austere	Some	HLH	5,000	60	301,255,280	14.97	15.59	0.04
206	180	Heavy	Austere	Some	HLH	5,000	90	290,353,579	16.85	16.91	0.00
207	180	Heavy	Austere	Some	HLH	20,000	60	303,695,445	13.94	14.05	0.01
208	180	Heavy	Austere	Some	HLH	20,000	90	293,763,800	15.22	15.24	0.00
209	180	Heavy	Austere	Some	HLH	50,000	60	308,575,775	12.71	12.32	-0.03
210	180	Heavy	Austere	Some	HLH	50,000	90	300,581,319	13.44	13.37	-0.01
211	180	Heavy	Austere	Some	LLL	5,000	60	191,738,728	10.62	10.51	-0.01
212	180	Heavy	Austere	Some	LLL	5,000	90	191,497,297	12.41	11.40	-0.08
213	180	Heavy	Austere	Some	LLL	20,000	60	185,659,352	8.99	9.47	0.05
214	180	Heavy	Austere	Some	LLL	20,000	90	185,440,774	10.10	10.28	0.02
215	180	Heavy	Austere	Some	LLL	50,000	60	173,500,599	7.14	8.31	0.16
216	180	Heavy	Austere	Some	LLL	50,000	90	173,324,803	7.74	9.01	0.16

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
217	180	Heavy	Developing	High	HHH	5,000	60	422,915,460	18.80	19.10	0.02
218	180	Heavy	Developing	High	HHH	5,000	90	386,681,683	20.51	20.72	0.01
219	180	Heavy	Developing	High	HHH	20,000	60	422,869,698	17.63	17.22	-0.02
220	180	Heavy	Developing	High	HHH	20,000	90	389,031,181	18.75	18.68	0.00
221	180	Heavy	Developing	High	HHH	50,000	60	422,778,174	16.23	15.10	-0.07
222	180	Heavy	Developing	High	HHH	50,000	90	393,730,177	16.87	16.38	-0.03
223	180	Heavy	Developing	High	HLH	5,000	60	310,804,937	15.42	16.12	0.05
224	180	Heavy	Developing	High	HLH	5,000	90	297,767,731	17.33	17.48	0.01
225	180	Heavy	Developing	High	HLH	20,000	60	313,511,779	14.40	14.53	0.01
226	180	Heavy	Developing	High	HLH	20,000	90	301,623,933	15.70	15.76	0.00
227	180	Heavy	Developing	High	HLH	50,000	60	318,925,461	13.17	12.75	-0.03
228	180	Heavy	Developing	High	HLH	50,000	90	309,336,336	13.91	13.82	-0.01
229	180	Heavy	Developing	High	LLL	5,000	60	201,959,023	11.14	10.87	-0.02
230	180	Heavy	Developing	High	LLL	5,000	90	199,395,553	12.96	11.79	-0.09
231	180	Heavy	Developing	High	LLL	20,000	60	196,408,054	9.53	9.80	0.03
232	180	Heavy	Developing	High	LLL	20,000	90	194,070,535	10.67	10.63	0.00
233	180	Heavy	Developing	High	LLL	50,000	60	185,306,116	7.70	8.59	0.12
234	180	Heavy	Developing	High	LLL	50,000	90	183,420,499	8.32	9.32	0.12
235	180	Heavy	Developing	None	HHH	5,000	60	314,167,878	13.96	13.66	-0.02
236	180	Heavy	Developing	None	HHH	5,000	90	285,796,614	14.96	14.81	-0.01
237	180	Heavy	Developing	None	HHH	20,000	60	313,581,777	13.02	12.31	-0.05
238	180	Heavy	Developing	None	HHH	20,000	90	287,045,479	13.63	13.35	-0.02
239	180	Heavy	Developing	None	HHH	50,000	60	312,409,574	11.90	10.80	-0.09
240	180	Heavy	Developing	None	HHH	50,000	90	289,543,209	12.22	11.71	-0.04
241	180	Heavy	Developing	None	HLH	5,000	60	219,746,020	11.12	11.52	0.04
242	180	Heavy	Developing	None	HLH	5,000	90	210,926,734	12.28	12.50	0.02
243	180	Heavy	Developing	None	HLH	20,000	60	221,529,341	10.31	10.39	0.01

Scenario Conditions with the Associated Class IV Consumption Rates

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Scenario Conditions with the Associated Class IV Consumption Rates

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SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
244	180	Heavy	Developing	None	HLH	20,000	90	213,491,945	11.07	11.27	0.02
245	180	Heavy	Developing	None	HLH	50,000	60	225,095,981	9.34	9.11	-0.02
246	180	Heavy	Developing	None	HLH	50,000	90	218,622,365	9.75	9.88	0.01
247	180	Heavy	Developing	None	LLL	5,000	60	128,619,962	7.50	7.77	0.04
248	180	Heavy	Developing	None	LLL	5,000	90	128,682,030	8.59	8.43	-0.02
249	180	Heavy	Developing	None	LLL	20,000	60	123,295,018	6.18	7.01	0.13
250	180	Heavy	Developing	None	LLL	20,000	90	123,349,169	6.80	7.60	0.12
251	180	Heavy	Developing	None	LLL	50,000	60	112,645,130	4.70	6.14	0.31
252	180	Heavy	Developing	None	LLL	50,000	90	112,683,446	5.00	6.66	0.33
253	180	Heavy	Developing	Some	HHH	5,000	60	391,071,248	17.34	17.13	-0.01
254	180	Heavy	Developing	Some	HHH	5,000	90	356,728,329	18.71	18.58	-0.01
255	180	Heavy	Developing	Some	HHH	20,000	60	390,492,836	16.20	15.44	-0.05
256	180	Heavy	Developing	Some	HHH	20,000	90	358,377,002	17.06	16.75	-0.02
257	180	Heavy	Developing	Some	HHH	50,000	60	389,336,012	14.83	13.55	-0.09
258	180	Heavy	Developing	Some	HHH	50,000	90	361,674,346	15.31	14.69	-0.04
259	180	Heavy	Developing	Some	HLH	5,000	60	277,660,967	13.93	14.45	0.04
260	180	Heavy	Developing	Some	HLH	5,000	90	266,800,147	15.49	15.68	0.01
261	180	Heavy	Developing	Some	HLH	20,000	60	279,922,402	12.94	13.03	0.01
262	180	Heavy	Developing	Some	HLH	20,000	90	270,024,260	13.98	14.13	0.01
263	180	Heavy	Developing	Some	HLH	50,000	60	284,445,272	11.76	11.43	-0.03
264	180	Heavy	Developing	Some	HLH	50,000	90	276,472,486	12.34	12.40	0.01
265	180	Heavy	Developing	Some	LLL	5,000	60	168,144,415	9.58	9.75	0.02
266	180	Heavy	Developing	Some	LLL	5,000	90	167,943,865	11.06	10.57	-0.04
267	180	Heavy	Developing	Some	LLL	20,000	60	161,886,308	7.98	8.79	0.10
268	180	Heavy	Developing	Some	LLL	20,000	90	161,701,234	8.86	9.53	0.08
269	180	Heavy	Developing	Some	LLL	50,000	60	149,370,096	6.18	7.71	0.25
270	180	Heavy	Developing	Some	LLL	50,000	90	149,215,970	6.64	8.36	0.26

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
271	180	Heavy	Well Developed	High	HHH	5,000	60	305,738,516	14.02	14.12	0.01
272	180	Heavy	Well Developed	High	HHH	5,000	90	276,014,023	15.14	15.31	0.01
273	180	Heavy	Well Developed	High	HHH	20,000	60	305,777,842	13.09	12.73	-0.03
274	180	Heavy	Well Developed	High	HHH	20,000	90	278,029,822	13.78	13.80	0.00
275	180	Heavy	Well Developed	High	HHH	50,000	60	305,856,493	11.99	11.16	-0.07
276	180	Heavy	Well Developed	High	HHH	50,000	90	282,061,422	12.33	12.11	-0.02
277	180	Heavy	Well Developed	High	HLH	5,000	60	215,408,616	11.30	11.91	0.05
278	180	Heavy	Well Developed	High	HLH	5,000	90	204,370,570	12.57	12.92	0.03
279	180	Heavy	Well Developed	High	HLH	20,000	60	217,653,982	10.49	10.74	0.02
280	180	Heavy	Well Developed	High	HLH	20,000	90	207,589,427	11.32	11.65	0.03
281	180	Heavy	Well Developed	High	HLH	50,000	60	222,144,714	9.52	9.42	-0.01
282	180	Heavy	Well Developed	High	HLH	50,000	90	214,027,141	9.95	10.22	0.03
283	180	Heavy	Well Developed	High	LLL	5,000	60	127,583,070	7.85	8.03	0.02
284	180	Heavy	Well Developed	High	LLL	5,000	90	124,970,068	9.06	8.71	-0.04
285	180	Heavy	Well Developed	High	LLL	20,000	60	123,210,314	6.57	7.24	0.10
286	180	Heavy	Well Developed	High	LLL	20,000	90	120,829,581	7.27	7.85	0.08
287	180	Heavy	Well Developed	High	LLL	50,000	60	114,464,803	5.12	6.35	0.24
288	180	Heavy	Well Developed	High	LLL	50,000	90	112,548,609	5.46	6.89	0.26
289	180	Heavy	Well Developed	None	HHH	5,000	60	230,621,482	10.62	10.53	-0.01
290	180	Heavy	Well Developed	None	HHH	5,000	90	208,770,305	11.46	11.42	0.00
291	180	Heavy	Well Developed	None	HHH	20,000	60	230,105,001	9.85	9.50	-0.04
292	180	Heavy	Well Developed	None	HHH	20,000	90	209,668,688	10.34	10.30	0.00
293	180	Heavy	Well Developed	None	HHH	50,000	60	229,072,039	8.94	8.33	-0.07
294	180	Heavy	Well Developed	None	HHH	50,000	90	211,465,455	9.17	9.03	-0.01
295	180	Heavy	Well Developed	None	HLH	5,000	60	157,983,546	8.44	8.89	0.05
296	180	Heavy	Well Developed	None	HLH	5,000	90	151,173,541	9.40	9.64	0.03
297	180	Heavy	Well Developed	None	HLH	20,000	60	159,289,841	7.76	8.01	0.03

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
298	180	Heavy	Well Developed	None	HLH	20,000	90	153,084,577	8.38	8.69	0.04
299	180	Heavy	Well Developed	None	HLH	50,000	60	161,902,431	6.96	7.03	0.01
300	180	Heavy	Well Developed	None	HLH	50,000	90	156,906,650	7.27	7.62	0.05
301	180	Heavy	Well Developed	None	LLL	5,000	60	87,881,041	5.65	5.99	0.06
302	180	Heavy	Well Developed	None	LLL	5,000	90	87,903,386	6.56	6.50	-0.01
303	180	Heavy	Well Developed	None	LLL	20,000	60	83,719,009	4.59	5.40	0.18
304	180	Heavy	Well Developed	None	LLL	20,000	90	83,738,503	5.09	5.86	0.15
305	180	Heavy	Well Developed	None	LLL	50,000	60	75,394,943	3.39	4.74	0.40
306	180	Heavy	Well Developed	None	LLL	50,000	90	75,408,737	3.62	5.14	0.42
307	180	Heavy	Well Developed	Some	HHH	5,000	60	290,081,525	13.24	12.98	-0.02
308	180	Heavy	Well Developed	Some	HHH	5,000	90	262,256,708	14.21	14.08	-0.01
309	180	Heavy	Well Developed	Some	HHH	20,000	60	289,574,356	12.30	11.70	-0.05
310	180	Heavy	Well Developed	Some	HHH	20,000	90	263,556,712	12.88	12.69	-0.01
311	180	Heavy	Well Developed	Some	HHH	50,000	60	288,560,018	11.20	10.26	-0.08
312	180	Heavy	Well Developed	Some	HHH	50,000	90	266,156,721	11.47	11.13	-0.03
313	180	Heavy	Well Developed	Some	HLH	5,000	60	198,451,866	10.48	10.95	0.04
314	180	Heavy	Well Developed	Some	HLH	5,000	90	189,599,024	11.62	11.88	0.02
315	180	Heavy	Well Developed	Some	HLH	20,000	60	200,237,981	9.67	9.87	0.02
316	180	Heavy	Well Developed	Some	HLH	20,000	90	192,170,823	10.39	10.71	0.03
317	180	Heavy	Well Developed	Some	HLH	50,000	60	203,810,212	8.71	8.66	-0.01
318	180	Heavy	Well Developed	Some	HLH	50,000	90	197,314,421	9.07	9.39	0.04
319	180	Heavy	Well Developed	Some	LLL	5,000	60	109,955,683	6.97	7.39	0.06
320	180	Heavy	Well Developed	Some	LLL	5,000	90	109,714,418	8.03	8.01	0.00
321	180	Heavy	Well Developed	Some	LLL	20,000	60	104,861,945	5.67	6.66	0.17
322	180	Heavy	Well Developed	Some	LLL	20,000	90	104,641,348	6.25	7.22	0.15
323	180	Heavy	Well Developed	Some	LLL	50,000	60	94,674,470	4.21	5.84	0.39
324	180	Heavy	Well Developed	Some	LLL	50,000	90	94,495,209	4.47	6.33	0.42

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
325	180	Light	Austere	High	HHH	5,000	60	412,735,132	24.11	25.25	0.05
326	180	Light	Austere	High	HHH	5,000	90	382,143,067	26.84	27.33	0.02
327	180	Light	Austere	High	HHH	20,000	60	412,932,481	22.38	22.36	0.00
328	180	Light	Austere	High	HHH	20,000	90	385,078,234	24.10	24.20	0.00
329	180	Light	Austere	High	HHH	50,000	60	413,324,926	20.43	19.29	-0.06
330	180	Light	Austere	High	HHH	50,000	90	390,894,181	21.35	20.87	-0.02
331	180	Light	Austere	High	HLH	5,000	60	318,262,996	20.34	21.38	0.05
332	180	Light	Austere	High	HLH	5,000	90	307,152,304	23.28	23.14	-0.01
333	180	Light	Austere	High	HLH	20,000	60	321,537,148	18.80	18.93	0.01
334	180	Light	Austere	High	HLH	20,000	90	311,766,685	20.71	20.48	-0.01
335	180	Light	Austere	High	HLH	50,000	60	328,083,201	17.06	16.33	-0.04
336	180	Light	Austere	High	HLH	50,000	90	320,941,059	18.05	17.67	-0.02
337	180	Light	Austere	High	LLL	5,000	60	225,429,783	15.44	14.26	-0.08
338	180	Light	Austere	High	LLL	5,000	90	223,071,941	18.27	15.43	-0.16
339	180	Light	Austere	High	LLL	20,000	60	219,473,524	13.15	12.62	-0.04
340	180	Light	Austere	High	LLL	20,000	90	217,422,450	14.88	13.66	-0.08
341	180	Light	Austere	High	LLL	50,000	60	207,558,754	10.71	10.89	0.02
342	180	Light	Austere	High	LLL	50,000	90	206,069,083	11.60	11.78	0.02
343	180	Light	Austere	None	HHH	5,000	60	266,276,945	15.61	15.38	-0.01
344	180	Light	Austere	None	HHH	5,000	90	242,881,639	16.74	16.64	-0.01
345	180	Light	Austere	None	HHH	20,000	60	265,902,186	14.38	13.62	-0.05
346	180	Light	Austere	None	HHH	20,000	90	244,535,800	15.02	14.73	-0.02
347	180	Light	Austere	None	HHH	50,000	60	265,152,668	13.02	11.74	-0.10
348	180	Light	Austere	None	HHH	50,000	90	247,844,122	13.33	12.71	-0.05
349	180	Light	Austere	None	HLH	5,000	60	188,245,087	12.50	13.02	0.04
350	180	Light	Austere	None	HLH	5,000	90	180,956,833	13.81	14.09	0.02
351	180	Light	Austere	None	HLH	20,000	60	190,478,940	11.44	11.53	0.01

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
352	180	Light	Austere	None	HLH	20,000	90	184,060,222	12.24	12.47	0.02
353	180	Light	Austere	None	HLH	50,000	60	194,946,644	10.25	9.94	-0.03
354	180	Light	Austere	None	HLH	50,000	90	190,267,001	10.62	10.76	0.01
355	180	Light	Austere	None	LLL	5,000	60	112,084,329	8.44	8.68	0.03
356	180	Light	Austere	None	LLL	5,000	90	112,084,329	9.64	9.39	-0.03
357	180	Light	Austere	None	LLL	20,000	60	106,492,348	6.73	7.69	0.14
358	180	Light	Austere	None	LLL	20,000	90	106,492,348	7.38	8.32	0.13
359	180	Light	Austere	None	LLL	50,000	60	95,308,385	4.95	6.63	0.34
360	180	Light	Austere	None	LLL	50,000	90	95,308,385	5.24	7.17	0.37
361	180	Light	Austere	Some	HHH	5,000	60	361,384,099	21.10	21.32	0.01
362	180	Light	Austere	Some	HHH	5,000	90	332,441,803	23.07	23.06	0.00
363	180	Light	Austere	Some	HHH	20,000	60	361,020,553	19.49	18.87	-0.03
364	180	Light	Austere	Some	HHH	20,000	90	334,596,749	20.68	20.42	-0.01
365	180	Light	Austere	Some	HHH	50,000	60	360,293,068	17.70	16.28	-0.08
366	180	Light	Austere	Some	HHH	50,000	90	338,900,901	18.31	17.62	-0.04
367	180	Light	Austere	Some	HLH	5,000	60	265,613,039	17.29	18.05	0.04
368	180	Light	Austere	Some	HLH	5,000	90	256,437,533	19.47	19.53	0.00
369	180	Light	Austere	Some	HLH	20,000	60	268,442,987	15.89	15.98	0.01
370	180	Light	Austere	Some	HLH	20,000	90	260,363,630	17.27	17.29	0.00
371	180	Light	Austere	Some	HLH	50,000	60	274,102,489	14.30	13.78	-0.04
372	180	Light	Austere	Some	HLH	50,000	90	268,210,084	14.98	14.91	0.00
373	180	Light	Austere	Some	LLL	5,000	60	172,075,802	12.30	12.03	-0.02
374	180	Light	Austere	Some	LLL	5,000	90	171,838,315	14.36	13.02	-0.09
375	180	Light	Austere	Some	LLL	20,000	60	165,325,269	10.11	10.65	0.05
376	180	Light	Austere	Some	LLL	20,000	90	165,118,648	11.30	11.53	0.02
377	180	Light	Austere	Some	LLL	50,000	60	151,823,811	7.80	9.19	0.18
378	180	Light	Austere	Some	LLL	50,000	90	151,673,574	8.38	9.94	0.19

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
379	180	Light	Developing	High	HHH	5,000	60	370,226,943	21.68	22.19	0.02
380	180	Light	Developing	High	HHH	5,000	90	339,604,032	23.72	24.01	0.01
381	180	Light	Developing	High	HHH	20,000	60	370,344,847	20.09	19.64	-0.02
382	180	Light	Developing	High	HHH	20,000	90	342,436,643	21.33	21.26	0.00
383	180	Light	Developing	High	HHH	50,000	60	370,580,655	18.31	16.95	-0.07
384	180	Light	Developing	High	HHH	50,000	90	348,101,864	18.95	18.34	-0.03
385	180	Light	Developing	High	HLH	5,000	60	275,754,806	17.91	18.78	0.05
386	180	Light	Developing	High	HLH	5,000	90	264,613,269	20.16	20.32	0.01
387	180	Light	Developing	High	HLH	20,000	60	278,949,514	16.51	16.63	0.01
388	180	Light	Developing	High	HLH	20,000	90	269,125,093	17.94	18.00	0.00
389	180	Light	Developing	High	HLH	50,000	60	285,338,931	14.94	14.35	-0.04
390	180	Light	Developing	High	HLH	50,000	90	278,148,742	15.65	15.52	-0.01
391	180	Light	Developing	High	LLL	5,000	60	182,921,594	13.01	12.52	-0.04
392	180	Light	Developing	High	LLL	5,000	90	180,532,905	15.15	13.55	-0.11
393	180	Light	Developing	High	LLL	20,000	60	176,885,890	10.86	11.09	0.02
394	180	Light	Developing	High	LLL	20,000	90	174,780,859	12.11	12.00	-0.01
395	180	Light	Developing	High	LLL	50,000	60	164,814,483	8.58	9.57	0.11
396	180	Light	Developing	High	LLL	50,000	90	163,276,766	9.20	10.35	0.13
397	180	Light	Developing	None	HHH	5,000	60	265,664,669	15.53	15.23	-0.02
398	180	Light	Developing	None	HHH	5,000	90	242,315,430	16.68	16.48	-0.01
399	180	Light	Developing	None	HHH	20,000	60	265,099,895	14.30	13.49	-0.06
400	180	Light	Developing	None	HHH	20,000	90	243,771,659	14.94	14.60	-0.02
401	180	Light	Developing	None	HHH	50,000	60	263,970,346	12.92	11.64	-0.10
402	180	Light	Developing	None	HHH	50,000	90	246,684,116	13.23	12.59	-0.05
403	180	Light	Developing	None	HLH	5,000	60	187,632,811	12.43	12.90	0.04
404	180	Light	Developing	None	HLH	5,000	90	180,390,624	13.75	13.96	0.01
405	180	Light	Developing	None	HLH	20,000	60	189,676,649	11.36	11.42	0.01

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
406	180	Light	Developing	None	HLH	20,000	90	183,296,081	12.16	12.36	0.02
407	180	Light	Developing	None	HLH	50,000	60	193,764,323	10.16	9.85	-0.03
408	180	Light	Developing	None	HLH	50,000	90	189,106,995	10.52	10.66	0.01
409	180	Light	Developing	None	LLL	5,000	60	111,472,053	8.36	8.60	0.03
410	180	Light	Developing	None	LLL	5,000	90	111,518,120	9.58	9.31	-0.03
411	180	Light	Developing	None	LLL	20,000	60	105,690,057	6.65	7.61	0.15
412	180	Light	Developing	None	LLL	20,000	90	105,728,206	7.30	8.24	0.13
413	180	Light	Developing	None	LLL	50,000	60	94,126,064	4.85	6.57	0.35
414	180	Light	Developing	None	LLL	50,000	90	94,148,379	5.14	7.11	0.38
415	180	Light	Developing	Some	HHH	5,000	60	338,971,309	19.78	19.60	-0.01
416	180	Light	Developing	Some	HHH	5,000	90	310,069,043	21.38	21.21	-0.01
417	180	Light	Developing	Some	HHH	20,000	60	338,428,486	18.24	17.36	-0.05
418	180	Light	Developing	Some	HHH	20,000	90	312,035,091	19.17	18.78	-0.02
419	180	Light	Developing	Some	HHH	50,000	60	337,342,838	16.52	14.97	-0.09
420	180	Light	Developing	Some	HHH	50,000	90	315,967,187	16.99	16.20	-0.05
421	180	Light	Developing	Some	HLH	5,000	60	243,200,249	15.96	16.60	0.04
422	180	Light	Developing	Some	HLH	5,000	90	234,064,774	17.78	17.96	0.01
423	180	Light	Developing	Some	HLH	20,000	60	245,850,919	14.63	14.70	0.00
424	180	Light	Developing	Some	HLH	20,000	90	237,801,972	15.75	15.90	0.01
425	180	Light	Developing	Some	HLH	50,000	60	251,152,259	13.13	12.68	-0.03
426	180	Light	Developing	Some	HLH	50,000	90	245,276,370	13.66	13.72	0.00
427	180	Light	Developing	Some	LLL	5,000	60	149,663,012	10.97	11.07	0.01
428	180	Light	Developing	Some	LLL	5,000	90	149,465,555	12.67	11.98	-0.05
429	180	Light	Developing	Some	LLL	20,000	60	142,733,201	8.86	9.80	0.11
430	180	Light	Developing	Some	LLL	20,000	90	142,556,990	9.79	10.60	0.08
431	180	Light	Developing	Some	LLL	50,000	60	128,873,581	6.63	8.45	0.28
432	180	Light	Developing	Some	LLL	50,000	90	128,739,860	7.06	9.15	0.29

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
433	180	Light	Well Developed	High	HHH	5,000	60	268,553,340	16.26	16.43	0.01
434	180	Light	Well Developed	High	HHH	5,000	90	242,795,510	17.58	17.78	0.01
435	180	Light	Well Developed	High	HHH	20,000	60	268,756,332	14.99	14.55	-0.03
436	180	Light	Well Developed	High	HHH	20,000	90	245,294,422	15.72	15.74	0.00
437	180	Light	Well Developed	High	HHH	50,000	60	269,162,316	13.58	12.55	-0.08
438	180	Light	Well Developed	High	HHH	50,000	90	250,292,247	13.89	13.58	-0.02
439	180	Light	Well Developed	High	HLH	5,000	60	190,430,636	13.14	13.91	0.06
440	180	Light	Well Developed	High	HLH	5,000	90	180,779,388	14.64	15.05	0.03
441	180	Light	Well Developed	High	HLH	20,000	60	193,163,869	12.03	12.32	0.02
442	180	Light	Well Developed	High	HLH	20,000	90	184,653,869	12.91	13.33	0.03
443	180	Light	Well Developed	High	HLH	50,000	60	198,630,335	10.78	10.62	-0.01
444	180	Light	Well Developed	High	HLH	50,000	90	192,402,829	11.16	11.50	0.03
445	180	Light	Well Developed	High	LLL	5,000	60	113,554,817	9.10	9.28	0.02
446	180	Light	Well Developed	High	LLL	5,000	90	111,129,366	10.49	10.04	-0.04
447	180	Light	Well Developed	High	LLL	20,000	60	108,697,327	7.36	8.21	0.12
448	180	Light	Well Developed	High	LLL	20,000	90	106,561,851	8.10	8.89	0.10
449	180	Light	Well Developed	High	LLL	50,000	60	98,982,347	5.54	7.08	0.28
450	180	Light	Well Developed	High	LLL	50,000	90	97,426,822	5.84	7.67	0.31
451	180	Light	Well Developed	None	HHH	5,000	60	197,631,155	12.02	11.87	-0.01
452	180	Light	Well Developed	None	HHH	5,000	90	179,155,019	12.99	12.84	-0.01
453	180	Light	Well Developed	None	HHH	20,000	60	197,136,001	10.98	10.51	-0.04
454	180	Light	Well Developed	None	HHH	20,000	90	180,260,766	11.50	11.37	-0.01
455	180	Light	Well Developed	None	HHH	50,000	60	196,145,693	9.84	9.06	-0.08
456	180	Light	Well Developed	None	HHH	50,000	90	182,472,260	10.04	9.81	-0.02
457	180	Light	Well Developed	None	HLH	5,000	60	135,951,206	9.57	10.05	0.05
458	180	Light	Well Developed	None	HLH	5,000	90	130,206,820	10.67	10.87	0.02
459	180	Light	Well Developed	None	HLH	20,000	60	137,518,018	8.66	8.90	0.03

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

Scenario Conditions with the Associated Class IV Consumption Rates

As Predicted by C4 and the Class IV Algorithm

SCENARIO NUMBER	LENGTH OF CONFLICT	TYPE OF FORCE	LEVEL OF EXISTING INFRASTRUCTURE	ENEMY LONG-DISTANCE STRIKE CAPABILITY	MOVEMENT PATTERN (HLH,LLL,HHH)	SIZE OF INITIAL FORCE	DAYS TO DEPLOY HALF OF TOTAL FORCE	PREDICTED TOTAL POUNDS CONSUMED	CLASS IV RATE COMPUTED BY MODEL C4	CLASS IV RATE COMPUTED BY ALGORITHM	% DIFFERENCE
460	180	Light	Well Developed	None	HLH	20,000	90	132,458,104	9.30	9.63	0.04
461	180	Light	Well Developed	None	HLH	50,000	60	140,651,641	7.65	7.67	0.00
462	180	Light	Well Developed	None	HLH	50,000	90	136,960,670	7.90	8.30	0.05
463	180	Light	Well Developed	None	LLL	5,000	60	75,750,259	6.35	6.70	0.05
464	180	Light	Well Developed	None	LLL	5,000	90	75,766,844	7.38	7.25	-0.02
465	180	Light	Well Developed	None	LLL	20,000	60	71,131,174	4.94	5.93	0.20
466	180	Light	Well Developed	None	LLL	20,000	90	71,144,908	5.46	6.42	0.18
467	180	Light	Well Developed	None	LLL	50,000	60	61,893,004	3.46	5.12	0.48
468	180	Light	Well Developed	None	LLL	50,000	90	61,901,037	3.65	5.54	0.52
469	180	Light	Well Developed	Some	HHH	5,000	60	253,491,747	15.26	14.96	-0.02
470	180	Light	Well Developed	Some	HHH	5,000	90	229,461,105	16.39	16.19	-0.01
471	180	Light	Well Developed	Some	HHH	20,000	60	253,020,167	13.98	13.24	-0.05
472	180	Light	Well Developed	Some	HHH	20,000	90	231,078,486	14.58	14.33	-0.02
473	180	Light	Well Developed	Some	HHH	50,000	60	252,077,005	12.57	11.42	-0.09
474	180	Light	Well Developed	Some	HHH	50,000	90	234,313,246	12.82	12.36	-0.04
475	180	Light	Well Developed	Some	HLH	5,000	60	174,070,119	12.10	12.66	0.05
476	180	Light	Well Developed	Some	HLH	5,000	90	166,431,478	13.41	13.70	0.02
477	180	Light	Well Developed	Some	HLH	20,000	60	176,245,469	10.99	11.21	0.02
478	180	Light	Well Developed	Some	HLH	20,000	90	169,516,363	11.75	12.13	0.03
479	180	Light	Well Developed	Some	HLH	50,000	60	180,596,169	9.76	9.67	-0.01
480	180	Light	Well Developed	Some	HLH	50,000	90	175,686,133	10.06	10.47	0.04
481	180	Light	Well Developed	Some	LLL	5,000	60	96,490,276	7.96	8.44	0.06
482	180	Light	Well Developed	Some	LLL	5,000	90	96,262,600	9.17	9.14	0.00
483	180	Light	Well Developed	Some	LLL	20,000	60	90,724,834	6.20	7.48	0.21
484	180	Light	Well Developed	Some	LLL	20,000	90	90,523,598	6.81	8.09	0.19
485	180	Light	Well Developed	Some	LLL	50,000	60	79,193,950	4.37	6.45	0.48
486	180	Light	Well Developed	Some	LLL	50,000	90	79,045,592	4.59	6.98	0.52

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